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WORK PLAN

FOR WATERSHED PROTECTION AND FLOOD PREVENTION

POTT-SEM-TURKEY WATERSHED

SEMINOLE AND POTAWATOMIE COUNTIES, OKLAHOMA



PREPARED UNDER THE AUTHORITY OF THE WATERSHED PROTECTION
AND FLOOD PREVENTION ACTS,
(PUBLIC LAW 566, 83rd CONGRESS, 68 STAT. 666), AS AMENDED

Prepared by: Seminole County Conservation District
Shawnee Conservation District
Pott-Sem-Turkey Watershed Conservancy District

With Assistance By:

U.S. DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE

MARCH 1975

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WATERSHED WORK PLAN

POTT-SEM-TURKEY WATERSHED
Seminole and Pottawatomie Counties, Oklahoma

Prepared Under the Authority of the Watershed
Protection and Flood Prevention Acts, (Public
Law 566, 83rd Congress, 68 Stat. 666), as
amended.

Prepared by: Seminole County Conservation District
(Sponsor)

Shawnee Conservation District
(Sponsor)

Pott-Sem-Turkey Watershed Conservancy District
(Sponsor)

With Assistance By

UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service
Forest Service

UNITED STATES DEPARTMENT OF INTERIOR
Bureau of Indian Affairs

June 1975

678527

ADDENDUM

POTT-SEM-TURKEY WATERSHED WORK PLAN

Pottawatomie and Seminole Counties,
Oklahoma

June 1975

ADDENDUM
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INTRODUCTION

This addendum is prepared in accordance with instructions for phase-in of Federal projects to conform to Principles and Standards planning procedures.

PROJECT BENEFIT-COST COMPARISON

The Pott-Sem-Turkey plan was developed using an interest rate of 5.875 percent. This addendum shows project benefits, costs, and benefit-cost ratios using the FY 1976 interest rate of 6.125 percent, current normalized prices for agricultural products, and 1974 construction costs.

Total average annual benefits	\$84,000
Average annual cost	\$70,700
Benefit-cost ratio	1.4:1.0
Benefit-cost ratio without secondary benefits	1.2:1.0

Revised August 1975

SELECTED ALTERNATE

NATIONAL ECONOMIC DEVELOPMENT ACCOUNT

Pott-Sem-Turkey Watershed
Seminole and Pottawatomie Counties, Oklahoma

Components	Measures of Effect 1/	Components	Measures of Effects 1/
Beneficial effects:		Adverse effects:	
A. The value to users of increased outputs of goods and services		A. A value of resources required for a plan.	
1. Flood prevention.	\$84,010	1. Floodwater retarding structures.	\$54,929
		Project installation (structural measures)	9,764
		Project administration OM&R	3,300
Total beneficial effects	\$84,010	Total adverse effects	\$67,993
		Net beneficial effects	\$16,017

1/ Average annual.

SELECTED ALTERNATE

ENVIRONMENTAL QUALITY

Pott-Sem-Turkey Watershed
Pottawatomie and Seminole Counties, Oklahoma

Components	Measures of effects	Components	Measures of effects
Beneficial and adverse effects:			
A. Areas of natural beauty.	<ol style="list-style-type: none"> 1. Create 11 lakes having a combined total of 297 surface acres of sediment pool area. 2. Reduce the average annual acres flooded from 2252 without project, to 813 with project conditions. 3. Increased output will provide funds and incentive for land improvements. 	C. Biological resources and selected ecosystems.	<ol style="list-style-type: none"> 1. Provide 297 acres of resting area at reservoirs for migratory waterfowl. 2. Control of mosquitoes and other vector insects will be made easier.
B. Quality considerations of water, land, and air resources.	<ol style="list-style-type: none"> 1. Reduce erosion and sediment on 356 acres. 2. Sediment delivery to the North Canadian R. will be reduced 55 percent. 	D. Irreversible or Irretrievable commitments.	<ol style="list-style-type: none"> 1. Conversion of 297 acres of pasture to permanent lake area. 2. An area of 883 acres will be subject to intermittent inundation in the flood pool areas.

SELECTED ALTERNATE

REGIONAL DEVELOPMENT ACCOUNT

Pott-Sem-Turkey Watershed
Seminole and Pottawatomie Counties, Oklahoma

Components	<u>Measures of Effects 1/</u>		Components	<u>Measures of Effects 1/</u>	
	<u>State of Oklahoma</u>	<u>Rest of Nation</u>		<u>State of Oklahoma</u>	<u>Rest of Nation</u>
Income.			Income.		
Beneficial effects:			Adverse effects:		
A. The value of increased output of goods & services to users residing in the region.			A. The value of resources contributed from within the region to achieve the outputs.		
1. Flood prevention	\$84,010	0	1. Floodwater retarding structures:	\$12,518	\$42,411
2. Secondary	16,450	0	Project installation (Structural measures)	224	9,540
			Project administration OM&R	3,300	0
Total beneficial effects	\$100,460	0	Total adverse effects	\$16,042	\$51,951
			Net beneficial effects	\$84,418	\$-51,951
<u>1/</u> Average annual.					

SELECTED ALTERNATE

REGIONAL DEVELOPMENT ACCOUNT

Pott-Sem-Turkey Watershed
Seminole and Pottawatomie Counties, Oklahoma

Components	Measures of Effects		Components	Measures of Effects	
	State of Oklahoma	Rest of Nation		State of Oklahoma	Rest of Nation
Employment.			Employment.		
Beneficial effects:			Adverse effects:		
A. Increase in the number and types of jobs.			A. Decrease in number and types of jobs.		
1. Agricultural employment.	Utilization of 3 man- yrs, annually, of employment in agri. production.	-	1. Lost in agricultural employment of project take area.	0	-
2. Employment for project construction.	14 man- yrs, of semi- skilled employment	-			
3. Employment for project OM&R	.2 man- yrs, annually of semi- skilled employment.	-			
Total beneficial effects	3.2 man- yrs of semi- skilled jobs, annually, and 14 man- yrs of semi- skilled employment during project construction.	-	Total adverse effects	0	-
			Net beneficial effects	3.2 man- yrs of semi- skilled jobs, annually, and 14 man- yrs of semi- skilled employment during project construction.	-

SELECTED ALTERNATE

REGIONAL DEVELOPMENT ACCOUNT

Pott-Sem-Turkey Watershed
Pottawatomie and Seminole Counties, Oklahoma

Components	Measures of Effects	
	State of Oklahoma	Rest of Nation
Population Distribution.		
Beneficial effects:	Creates 3.2 man-yrs, annually, of semi- skilled jobs, & 14 man-yrs of semi- skilled jobs during project construction in an area that had a population reduction of 10.4 percent between the years of 1960 and 1970.	-
Adverse effects:		-
Regional Economic Base and Stability.		
Beneficial effects:	Creates 3.2 man-yrs, annually, of employment in semi-skilled jobs, & 14 man-yrs of semi- skilled jobs during project construction in an area where 22 percent of the families have incomes of less than \$3,000 per year in 1969.	-

SELECTED ALTERNATE

SOCIAL WELL-BEING

Pott-Sem-Turkey Watershed
Pottawatomie and Seminole Counties, Oklahoma

Components

Measures of Effects

Beneficial and Adverse Effects:

A. Real income distribution.

1. 50 owners and operators of floodplain lands will be directly benefited by reduced flood damage to crops, pastures, and improvements. The value of the benefits will amount to about \$37,000, annually. The average gross sales per farm in 1969 were about \$7,600.
2. Employment will be increased by 3.2 man-years of annual employment and 14 man-years of employment during project construction.

B. Life, health, and safety.

1. The probability of the loss of lives, as a result of rapid floodplain inundation due to storms of high intensity, will be decreased.
 2. Tension and worry about flood losses will be reduced.
-

Environmental Quality Plan 1/
for
Pott-Sem-Turkey Watershed
Seminole and Pottawatomie Counties, Oklahoma

Preface

The purpose of this plan is not to supplant the objectives of the local sponsoring organizations or their efforts to formulate a plan tailored to their specific needs, but to reflect the broad range of environmental concerns within the watershed and possible courses of action to improve the environment in these areas of concern.

Though the concept of environmental quality may differ between individuals, we must recognize the need to face universal problems and seek mutually satisfactory solutions for them. The responsibility of the planner is to explore, evaluate, and present the full spectrum of available alternatives for the solution of a given problem or collection of problems. Conventional thinking and ingrained planning habits must be continually modified to reflect technological advances, to utilize innovative planning techniques, and to accomodate new and broadened objectives.

Objective

The objective of this plan is the maintenance and enhancement of natural and cultural resources and ecological systems as a source of present enjoyment and a heritage for future generations.

Components and Needs

- I. Preservation and management of open and green space to prevent encroachment from nearby urban areas.
- II. Preservation and enhancement of Turkey Creek through abatement of solid waste pollution.
- III. Creation of a reservoir-centered recreation area within the watershed.
- IV. Creation and management of a wetland area.
- V. Enhancement and management of wildlife resources through restoration of depleted species and decimated populations.
- VI. Preservation and enhancement of archeological resources.
- VII. Enhancement of water quality through the reduction of suspended sediment concentrations in streamflows.
- VIII. Enhancement of land quality through treatment of erosion and elimination of visual blight.

1/ Abbreviated in compliance with WRC phase-in procedures for application of Principles and Standards for Planning Water and Related Land Resources.

- IX. Enhancement of air quality through reduction of dust resulting from vehicular traffic on unpaved roads.
- X. Protection of the tenuous balance of fragile aquatic and terrestrial ecosystems through education of the local public.

Plan Elements and Probable Impacts

- I. In view of the relative proximity of the Oklahoma City metropolitan area to the watershed, consideration should be given to a land zoning ordinance to insure that creeping suburbanization does not infringe upon the open and green space of the watershed and destroy the rural atmosphere. This element of the plan would be contingent upon the formation of a legal zoning authority.
- II. Turkey Creek is polluted with rubber tires, tin cans, rags, paper, discarded furniture, and other solid waste that has been dumped from almost every bridge in the watershed. A cooperative effort between local government and civic groups could provide the necessary equipment and manpower to clean up the pollution and restore much of the natural beauty of the area.
- III. Even though recreation needs for area residents are met by numerous other surrounding facilities, the environment of the watershed would be enhanced by the creation of a reservoir-centered recreation area. A two-hundred acre lake could be created, with an accompanying one-hundred acre recreation development for local residents to provide facilities within a short driving distance for spontaneous, spur-of-the-moment fishing, boating, and picnicking excursions that are precluded by more distant recreation areas.
- IV. There are presently no wetland areas in the watershed. The area is in the Central Flyway of waterfowl migration routes and could offer resting and feeding areas for ducks and geese. In addition, many of the local children have never had the opportunity to observe such wildlife species as beaver, muskrat, mink, and river otter that often frequent wetland areas. The lower end of the Turkey Creek floodplain offers a suitable location for the development of about 350 acres of wetland. A system of dikes, water wells and pumps would be required for establishment of the wetland area. Federal and state wildlife agencies could furnish assistance in stocking the mink and otter. The beaver and muskrat would populate the area naturally from stock presently existing in the North Canadian River.

- V. A 1,200 acre upland wildlife preserve could be created in the watershed. Re-establishment of small populations of indigenous wildlife species, with proper protection and management would serve not only as an educational tool in the form of an outdoor classroom, but as a source of enjoyment to the general public.
- VI. A professional archeologist has identified 25 regionally significant archeological sites in the watershed. This plan proposes the selection of one site for restoration and the establishment of a museum to display and explain local prehistory and early history. Other significant archeological sites will be protected until such time as suitable salvage techniques have been developed to insure the retrieval of all information and data to be obtained from such sites.
- VII. Suspended sediment has a detrimental effect on the quality of water in the watershed. The sediment creates a red, muddy appearance in the water that is visually displeasing. A program of land treatment on the upland is planned to reduce erosion, thereby reducing sediment available for transport by streamflows and improving the quality of the water. The land treatment program on cropland will involve a combination of conservation cropping systems, contour farming, and crop residue management. Land treatment on grassland will involve pasture planting, range seeding, deferred grazing, proper grazing use, brush control and farm ponds.
- VIII. Land quality in the watershed is depreciated by erosion that has occurred on extensive areas damaged by oil and salt water spills resulting from drilling activities. Adding to this visual blight are numerous roadside dumps where local residents dispose of trash. This plan proposes that about 450 acres damaged by salt water and oil spills receive intensive treatment to restore soil fertility and vegetative cover and that about 15 roadside dumps be cleaned up, with provision for a sanitary landfill to be operated for the benefit of watershed residents.
- IX. About 50 miles of gravel and dirt-surfaced roads in the watershed contribute dust to the atmosphere. This plan proposes that a survey of travel patterns be made to determine which roads could be closed, and that the remainder be hard-surfaced to reduce air pollution.
- X. The interrelationship of ecosystems affecting man's very existence is not fully understood by the general public. We continue to operate with the attitude that what we do with our land and on our land is our business. This plan proposes a series of educational presentations in the local community on the vast implications of cumulative individual abuses of our natural heritage to instill in each of us a sense of not only community responsibility, but world responsibility for the

actions of each individual on his land. Experts in appropriate fields, could be scheduled to offer instruction during a series of sessions.

Costs

I.	\$ 5,000
II.	8,200
III.	110,000
IV.	120,000
V.	240,000
VI.	35,000
VII.	215,000
VIII.	140,250
IX.	122,500
X.	4,375

Total estimated cost of Environmental Quality Plan	\$1,000,325
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WATERSHED WORK PLAN AGREEMENT

between the

Seminole County Conservation District
Local Organization

Shawnee Conservation District
Local Organization

Pott-Sem-Turkey Watershed Conservancy District
Local Organization

State of Oklahoma
(hereinafter referred to as the Sponsoring Local Organization)

and the

Soil Conservation Service
United States Department of Agriculture
(hereinafter referred to as the Service)

Whereas, application has heretofore been made to the Secretary of Agriculture by the Sponsoring Local Organization for assistance in preparing a plan for works of improvement for the Pott-Sem-Turkey
Watershed, State of Oklahoma
under the authority of the Watershed Protection and Flood Prevention Act (Public Law 566, 83d Congress; 68 Stat. 666), as amended; and

Whereas, the responsibility for administration of the Watershed Protection and Flood Prevention Act, as amended, has been assigned by the Secretary of Agriculture to the Service; and

Whereas, there has been developed through the cooperative efforts of the Sponsoring Local Organization and the Service a mutually satisfactory plan for works of improvement for the Pott-Sem-Turkey
Watershed, State of Oklahoma,
hereinafter referred to as the watershed work plan, which plan is annexed to and made a part of this agreement;

Now, therefore, in view of the foregoing considerations, the Sponsoring Local Organization and the Secretary of Agriculture, through the Service, hereby agree on the watershed work plan, and further agree that the works of improvement as set forth in said plan can be installed in about 5 years.

It is mutually agreed that in installing, operating and maintaining the works of improvement substantially in accordance with the terms, conditions, and stipulations provided for in the watershed work plan:

1. The sponsoring local organization will acquire with other than PL-566 funds, such land rights as will be needed in connection with the works of improvement, (Estimated cost \$210,749).

<u>Works of Improvement</u>	<u>Sponsoring Local Organizations</u> (percent)	<u>Service</u> (percent)	<u>Estimated Land Rights Cost</u> (dollars)
Floodwater Retarding Structures No. 1 through 11	100	0.0	210,749

2. The sponsoring local organization assures that comparable replacement dwellings will be available for individuals and persons displaced from dwellings, and will provide relocation assistance advisory services and relocation assistance, make the relocation payments to displaced persons, and otherwise comply with the real property acquisition policies contained in the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (Public Law 91-646, 84 Stat. 1894) effective as of January 2, 1971, and the Regulations issued by the Secretary of Agriculture pursuant thereto. The costs of relocation payments will be shared by the sponsoring local organization and the Service as follows:

	<u>Sponsoring Local Organization</u> (percent)	<u>Service</u> (percent)	<u>Estimated Relocation Payment Costs</u> (dollars) <u>1/</u>
Relocation Payments	31.5	68.5	0.0

- 1/ Investigation has disclosed that under present conditions the project measures will not result in the displacement of any person, business, or farm operation. However, if relocations become necessary, relocation payments will be cost-shared in accordance with the percentage shown.

3. The Sponsoring Local Organization will acquire or provide assurance that landowners or water users have acquired such water rights pursuant to State law as may be needed in the installation and operation of the works of improvement.
4. The percentages of construction costs of structural measures to be paid by the Sponsoring Local Organization and by the Service are as follows:

<u>Improvement</u>	<u>Sponsoring Local Organization (percent)</u>	<u>Service (percent)</u>	<u>Estimated Construction Cost (dollars)</u>
Floodwater Retarding Structures No. 1 thru 11	0	100.00	635,645

5. The percentages of the engineering costs to be borne by the Sponsoring Local Organization and the Service are as follows:

<u>Works of Improvement</u>	<u>Sponsoring Local Organization (percent)</u>	<u>Service (percent)</u>	<u>Estimated Engineering Costs (dollars)</u>
Floodwater Retarding Structures No. 1 thru 11	0	100.00	83,792

6. The Sponsoring Local Organization, Bureau of Indian Affairs, and the Service will each bear the costs of Project Administration which it incurs, estimated at \$3,800, \$2,800, and \$159,037, respectively.
7. The Sponsoring Local Organization will obtain agreements from owners of not less than 50 percent of the land above each reservoir and floodwater retarding structure that they will carry out conservation farm or ranch plans on their land.
8. The Sponsoring Local Organization will provide assistance to landowners and operators to assure the installation of the land treatment measures shown in the watershed work plan.
9. The Sponsoring Local Organization will encourage landowners and operators to operate and maintain the land treatment measures for the protection and improvement of the watershed.

10. The Sponsoring Local Organization will be responsible for the operation and maintenance of the structural works of improvement by actually performing the work or arranging for such work in accordance with agreements to be entered into prior to issuing invitations to bid for construction work.
11. The costs shown in this agreement represent preliminary estimates. In finally determining the costs to be borne by the parties hereto, the actual costs incurred in the installation of works of improvement will be used.
12. This agreement is not a fund obligating document. Financial and other assistance to be furnished by the Service in carrying out the watershed work plan is contingent on the appropriation of funds for this purpose.

A separate agreement will be entered into between the Service and the Sponsoring Local Organization before either party initiates work involving funds of the other party. Such agreement will set forth in detail the financial and working arrangements and other conditions that are applicable to the specific works of improvement.

13. The watershed work plan may be amended or revised, and this agreement may be modified or terminated only by mutual agreement of the parties hereto except for cause. The Service may terminate financial and other assistance in whole, or in part, at any time whenever it is determined that the Sponsoring Local Organization has failed to comply with the conditions of this agreement. The Service shall promptly notify the Sponsoring Local Organization in writing of the determination and the reasons for the termination, together with the effective date. Payments made to the Sponsoring Local Organization or recoveries by the Service under projects terminated for cause shall be in accord with the legal rights and liabilities of the parties.
14. No member of or delegate to Congress, or resident commissioner, shall be admitted to any share or part of this agreement, or to any benefit that may arise therefrom; but this provision shall not be construed to extend to this agreement if made with a corporation for its general benefit.
15. The program conducted will be in compliance with all requirements respecting nondiscrimination as contained in the Civil Rights Act of 1964 and the regulations of the Secretary of Agriculture (7 C.F.R. Sec. 15.1-15.12), which provide that no person in the United States shall, on the ground of race, color, or national origin, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any activity receiving Federal financial assistance.

16. This agreement will not become effective until the Service has issued a notification of approval and authorizes assistance.

Seminole County Conservation District
Local Organization

By Earl Jackson

Title chairman

Date July 7, 1975

The signing of this agreement was authorized by a resolution of the
governing body of the Seminole County Conservation District
Local Organization

adopted at a meeting held on July 7, 1975

Gris H. Meredith
(Secretary, Local Organization)

Date July 7, 1975

Shawnee Conservation District
Local Organization

By Jim White

Title Chairman

Date July 10, 1975

The signing of this agreement was authorized by a resolution of the
governing body of the Shawnee Conservation District
Local Organization

adopted at a meeting held on July 10, 1975

L. Roy Bryan
(Secretary, Local Organization)

Date July 10, 1975

Pott-Sem-Turkey Watershed Conservancy District

Local Organization

By *Karl M. [unclear]*

Title *Chairman*

Date *July 7, 1975*

The signing of this agreement was authorized by a resolution of the governing body of the Pott-Sem-Turkey Watershed Conservancy District
Local Organization

adopted at a meeting held on *July 7, 1975*

Carol M. [unclear]

(Secretary, Local Organization)

Date *July 7, 1975*

Appropriate and careful consideration has been given to the environmental statement prepared for this project and to the environmental aspects thereof.

Soil Conservation Service
United States Department of Agriculture

By *[Signature]*

Date July 23, 1975

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WATERSHED WORK PLAN

POTT-SEM-TURKEY WATERSHED

Seminole and Pottawatomie Counties, Oklahoma

June 1975

SUMMARY OF PLAN

The work plan for watershed protection and flood prevention for the Pott-Sem-Turkey Watershed, Oklahoma, was prepared by the Seminole County and Shawnee Conservation Districts and the Pott-Sem-Turkey Watershed Conservancy District, Oklahoma, as the sponsoring local organizations. Technical assistance was provided by the Soil Conservation Service and Forest Service of the U. S. Department of Agriculture, and the Bureau of Indian Affairs of U. S. Department of Interior.

The watershed covers an area of 54.0 square miles and is located in Seminole and Pottawatomie Counties approximately eight miles northwest of Seminole, Oklahoma.

Approximately 18 percent of the watershed is cropland, 21 percent is rangeland, 41 percent is pasture, 17 percent is forest land, and 3 percent is miscellaneous. All land is privately owned.

Three major problems affect the watershed area. These problems are: 1) the lack of conservation treatment on agricultural land; 2) flood damages to crops, pasture, farm property, and public roads; and 3) lack of wildlife conservation and promotion or enhancement of wildlife resources.

The sponsoring local organizations have set as their minimum objectives the following items which have been concurred in by the Soil Conservation Service: 1) develop basic soil and water conservation plans and apply the needed land treatment measures which will contribute directly to watershed protection, flood prevention and sediment reduction; 2) reduce agricultural floodwater damages 70 to 80 percent; and 3) plan mitigating measures which will compensate for the damage to fish and wildlife incurred by the installation of the project. The project was formulated to and will accomplish these objectives when installed.

Works of improvement included in the plan consist of: 1) conservation land treatment measures to be installed on 2,380 acres of cropland, 14,106 acres of pastureland, and 5,761 acres of rangeland; 2) structural measures consisting of eleven floodwater retarding structures; and 3) wildlife mitigating measures consisting of wildlife plantings and brush shelters associated with Sites 1, 3, 4, and 8.

Land treatment measures will cost an estimated \$214,833 and structural measures, \$1,097,423. Mitigating measures costs are included in the construction costs of the structures.

The plan is designed to be completed in five years. Land treatment will be stressed throughout the project installation period. Structural measures are planned to be installed in the second through fifth years provided minimum land treatment has been applied.

Installation of the project will yield an estimated \$100,460 in annual benefits. Average annual costs of the project is \$67,993. The project will yield an estimated \$1.50 in benefits for each dollar of costs. Approximately fifty landowners will benefit directly from installation of the project.

The Pott-Sem-Turkey Watershed Conservancy District was organized to cover the benefited area of the project. This Conservancy District has the authority to participate in watershed protection and flood prevention projects, including the power of assessment and eminent domain. If necessary, funds for the non-Federal share of costs of installing, operating, and maintaining structural measures (including mitigating measures) will be provided by the Conservancy District by assessment on benefited areas.

Land treatment measures will be installed by landowners or operators utilizing whatever cost-sharing there is available from presently going programs. These measures will be operated and maintained by landowners or operators under terms of their individual soil and water conservation plan.

Structural works of improvement will be maintained by the Seminole County Conservation District and the Pott-Sem-Turkey Watershed Conservancy District. Maintenance will be performed by the sponsors with funds raised by assessments on benefited land when needed. The average annual maintenance cost is estimated at \$3,300.

WATERSHED RESOURCES - ENVIRONMENTAL SETTING

Physical Data

The Pott-Sem-Turkey Watershed is located in central Oklahoma about thirty-five miles east of Oklahoma City. Turkey Creek heads about two miles north of Earlsboro and flows in a northeasterly direction for approximately 14 miles to its confluence with the North Canadian River.

The watershed has a drainage area of 34,560 acres (54.0 square miles) and is located in the Arkansas-White-Red water resource region and the North Canadian River sub-region. About 31,040 acres of the drainage area is in Seminole County and 3,520 acres are in Pottawatomie County.

The watershed is in the Central Rolling Red Prairies and Cross Timbers Land Resource Areas. Most of the upland soils are deep to moderately deep, medium textured, slowly permeable to permeable, and moderately productive. There are a few areas of deep, medium textured to clayey, permeable to slowly permeable soils. Bottomland soils are deep, medium textured, permeable and highly productive. Erosion on cultivated upland soils and flooding on bottomland soils have been serious problems in past years. An effective program of land treatment has greatly alleviated the upland erosion problem but flooding on bottomland soils remains a serious threat to agricultural enterprises.

The capability classification is an interpretive grouping of standard soil survey information made primarily for agricultural purposes. The classification was developed by the Soil Conservation Service to assist farmers and ranchers in developing plans for proper use of their land. Classes I, II, and III include the land suitable for regular cultivation with the application of appropriate conservation measures. Class IV land is best suited for use as pastureland or hayland, but may be cultivated occasionally with proper safeguards. Classes V, VI, and VII are not suited for cultivation but may be used for grazing, or for forestry if soil and climate permit. Class VIII land is unsuited to agricultural uses but may be adapted to recreation, wildlife, or other uses. Twelve percent of the watershed area is Capability Class II, 6 percent Class III, 8 percent Class IV, 4 percent Class V, 68 percent Class VI, and 2 percent Class VII.

The land use of the watershed is:

<u>LAND USE</u>	<u>ACRES</u>	<u>PERCENT</u>
Cropland	6,200	18.0
Rangeland	7,260	21.0
Pastureland	14,000	41.0
Forestland	6,000	17.0
Miscellaneous	<u>1,100</u>	<u>3.0</u>
TOTAL	34,560	100.0

There are 1,240 acres under the jurisdiction of the Bureau of Indian Affairs. There is no Federally owned land in the watershed.

The watershed is on the western edge of the Prairie Plains Homocline Tectonic Province. The exposed rocks are westward dipping shales and sandstones of Lower Permian and Upper Pennsylvanian age. There are a few areas of high lying alluvium which are Pleistocene in age. Geological formations exposed from west to east (youngest to oldest) are as follows:

<u>Period</u>	<u>Formation</u>	<u>Description</u>
Permian	Konawa	Primarily red shale with thin sandstone stringers. The Brownsville limestone member occurs at the base.
Pennsylvanian	Vanoss) Ada)	Predominately shale with interbedded sandstones and thin limestones.

Topography in the watershed is gently rolling to hilly with mean sea level elevations ranging from about 870 feet to about 970 feet. The stream channel gradient averages about 7.0 feet per mile and the floodplain ranges in width from 2,500 feet to 900 feet or less. The total floodplain of Turkey Creek and its tributaries, excluding the stream channels, is 2,564 acres.

The population of the watershed is rural in nature though many residents commute daily to jobs in Shawnee and Oklahoma City.

Oil and gas are the only minerals of commercial significance in the watershed. Petroleum production began about 1925 and for the period from 1925 through 1948 oil production for Seminole County averaged almost 43 million barrels per year. By 1952 production had declined to about 9 million barrels.

Ground water from sandstone and conglomerate members of the Vamoosa and Vanoss formations is of generally good quality and is available in adequate quantity for local domestic uses. Some water is also obtained from alluvium in the floodplain area.

The channels of Turkey Creek and its tributaries are classified according to the United States Department of Agriculture, Watershed Protection Handbook, as N (natural, unmodified, well defined channels), and I (intermittent flow). There are no wetland acres in the watershed.

The watershed lies in the sub-humid climatic zone. The average frost-free period of 218 days extends from March 28 to November 4. The mean temperatures range from 81.0 degrees Fahrenheit in summer to 40.0 degrees in winter. The extreme recorded temperatures were 12 degrees below zero and 118 degrees above zero.

The average annual rainfall recorded at the Shawnee gage, about six miles west of the watershed, is 37.22 inches. The minimum of 18.63 inches fell in 1936 and the maximum of 59.71 inches was recorded in 1957.

Forty percent of the rainfall occurs during the months of April, May, and June. The remaining 60 percent is distributed rather uniformly throughout the other nine months. Flood producing storms may occur in any month of the year but they are most frequent during the spring months.

Economic Data

There are about 140 farms or ranches in the watershed. These range in size from approximately 40 acres to 640 acres. Recent land sales in the watershed have indicated a floodplain land market value of \$400 per acre and an upland land value of \$150 per acre. These values are higher than the Seminole County average land value principally due to the watersheds' relatively short distance from Oklahoma City and Shawnee.

The accessibility of farms and ranches to roads and markets is good. There are about 20 miles of hard surfaced Federal, State, and County highways. There is also a network of county roads, many of which have been graveled. Interstate Highway No. 40 crosses the northern portion of the watershed giving easy access to Oklahoma City where an important stocker cattle market is located. State Highways 3, 99, and 99A also cross the watershed at various places.

The major agricultural industry is beef cattle production. The primary use of the floodplain lands is the production of crops in support of this industry.

Dairying is the primary agricultural enterprise in the area that is operated as a family enterprise.

In 1969 Seminole County, in which a major portion of the watershed is located, had a total civilian labor force of 8,850. Of this total, 14 percent had agricultural employment. It is estimated that 75 percent of the farm operators in the watershed have some off farm employment. Most of the farm operators with off farm employment commute to Seminole, Shawnee, Midwest City, and Oklahoma City.

During the five years from 1964 to 1969, the sales from livestock, poultry, and their products in Seminole County increased about 85 percent. The sales of these products in 1969 amounted to about 90 percent of the total agricultural products sold in the county.

Other census data for Seminole County that would be descriptive of the watershed are as follows:

<u>Item</u>	<u>1964</u>	<u>1969</u>
Average size of all farms (acres)	238	295
Value of land and buildings per farm	\$18,832	\$ 37,615
Value of land and buildings per acre	\$ 82	\$ 128
Proportion of tenancy (percent)	13	9
Average age of farm operators	52	53

Fish and Wildlife Resources

Under present watershed conditions, there is practically no fishing in the upper reaches of Turkey Creek due to the intermittent nature of the stream. In a pool at the lower end of the creek, near its confluence with the North Canadian River, there is a moderate amount of fishing by local fishermen. The quality or amount of stream fishing is not expected to change significantly in the future without or with the project.

Wildlife includes white-tailed deer, wild turkeys, bobwhites, fox squirrels, mourning doves, waterfowl, raccoons, skunks, opossums, bobcats, foxes, mink, and coyotes.

The white-tailed deer and wild turkey populations are small but increasing and should provide more hunting in the future.

Due to the interspersation of cover and cultivated fields, the watershed provides very good habitat for bobwhites. Moderate numbers of fox squirrels are found along the wooded streamcourses. Habitat for cottontails is moderate and for mourning doves is good.

Waterfowl use of the watershed is restricted to resting and some feeding on farm ponds during periods of migration.

There is a limited amount of sport hunting for raccoons and coyotes. Trapping for fur animals is limited and fur pelts are marketed from the local area.

Recreational Resources

There are no public recreation areas within the watershed. Shawnee Reservoir provides the nearest waterbased public recreation area.

There are several floodwater retarding structures about ten miles east of the watershed that are open to the public at no charge. These sites, in addition to 50 or 60 others within a 90 minute drive of Oklahoma City, are publicized by the Oklahoma State Conservation Commission in a brochure available to the public.

Water stored in sediment pools of these floodwater retarding structures in the area have water of good quality and have proven very popular for fishing. Sanitary facilities at these structure sites are limited to essential needs.

Archeological and Historical Values and Unique Scenic Areas

Apparently the watershed area was considered a marginal resource area by prehistoric populations. No large campgrounds or areas suggesting lengthy occupations have been encountered. Extant archeological sites indicate only limited excursions into the area.

The campground locations were probably occupied only as long as a readily available food supply existed. When these resources were exhausted, the group moved to another location. Workshop sites of a similar nature were used during brief excursions into the area to obtain needed lithic materials.

A total of 25 archeological sites have been identified in proximity to the floodwater retarding structures proposed in this project. Eleven of these locations are workshop sites of undetermined age or occupational period. Seven campground sites and one workshop site are assigned to the Southern Plains Archaic occupational period. Of the six remaining sites, two are Late Prehistoric in age and four are Late Historic age homestead or cemetery sites.

Soil, Water, and Plant Management Status

The land use trend in the watershed has been from row crops to tame pasture and hayland. Some alfalfa and peanuts are grown as cash crops and small grains and hay-grazer for feed and forage.

The watershed area is served by the Soil Conservation Service Field Offices located at Wewoka and Shawnee, Oklahoma. These field offices provide technical assistance to the Seminole County and Shawnee Conservation Districts. The field offices have assisted the farmers and ranchers in preparing 205 basic soil and water conservation plans on 26,982 acres. About 60 percent of the planned practices have been applied. Forestry assistance is available from the Oklahoma Department of Agriculture, Division of Forestry.

The Land Operations Work Unit Offices of the Bureau of Indian Affairs located at Wewoka and Shawnee, Oklahoma, furnish technical assistance to farmers operating Indian allotments. This assistance is given through conservation plans and lease stipulations. Of the 1,240 acres of restricted land, 720 acres are under conservation plan with 48 percent of the planned treatment applied.

WATER AND RELATED LAND RESOURCE PROBLEMS

Land Treatment

Installation of adequate land treatment on individual farms and ranches in the watershed has been a difficult achievement. Much of the upland, though not suited to intensive cultivation, was planted to row crops in the early years of statehood. By the time the Soil Conservation movement gained momentum in the 1930's and 40's, severe damage had already been done to most of the shallow soils. The land was retired from cultivation only when there was no longer enough soil on the underlying rock to support cultivated crops. Plow grooves are still visible on sandstone outcrops in many abandoned fields.

Natural re-establishment of grass cover on eroded areas was slow and scrub trees and brush invaded many old fields. By the 1960's conservation practices were present in quantities sufficient to stem the ruinous erosion on much of the watershed though the job is yet far from complete.

Floodwater Damage

Under present land use conditions, a 24-hour, 100-year frequency storm would yield 6.13 inches of surface runoff and inundate 2,564 acres. The average annual acres flooded are estimated to be 2,252.

The floodplain ranges in width from 2,500 feet in the lower reaches to 900 feet or less in the upper reaches. The general floodplain land use is: alfalfa, 18 percent; small grain, 22 percent; grain sorghums, 5 percent; pasture, 50 percent; and miscellaneous, 5 percent. The respective yields are 4 tons, 48 bushels, 60 bushels, and 160 pounds of beef per acre.

Floodplain landowners report that storms of major proportions, those flooding more than 50 percent of the floodplain, occur once each year, on an average. In 1947 eight floods occurred. Road and bridge damages were severe in 1957. Two damaging floods occurred in 1969. The frequency of flooding has had a significant influence in limiting the floodplain soils in production below their capabilities. This has a noticeable effect on the area economy.

Turkey Creek has flooded State Highway 99 to a depth of 3-feet, two times in the last 24 years. Cars have been washed from roads during these occurrences, creating a hazard to life.

The two-year frequency storm of 24-hour duration will flood 1,707 acres. It is estimated that as a result of this flooding crop and pasture, other agricultural and non-agricultural damages will amount to \$20,700, under without-project land use conditions.

The average annual gross value of crop and pasture production per acre (current normalized prices, 10/15/73) for the floodplain is about \$93.

Based upon without-project land use conditions, it is estimated that the monetary average annual direct and indirect damages, as a result of flooding, based upon a 100-year evaluation period, will amount to \$112,000 (current normalized prices, 10/15/73). These damages are itemized as follows:

<u>ITEM</u>	<u>DAMAGES</u>
Crop and Pasture	\$ 57,760
Other Agricultural (fences, debris, etc.)	10,240
Non-agricultural (roads, bridges, etc.)	22,440
Sediment	7,300
Erosion	1,180
Indirect	<u>13,080</u>
 TOTAL	 \$112,000

Some species of wildlife suffer from floodwaters. These include burrowing animals, rabbits, and ground nesting birds.

Erosion Damage

Sheet erosion on formerly cultivated and cultivated land in the upland portion of the watershed is the major source of sediment. Gully and roadside erosion considering the whole watershed are moderate. Gullies in formerly cultivated upland fields are mostly v-shaped and are relatively shallow, generally ranging from two to six feet in depth. There are few active overfalls and establishment of vegetation on gully slopes, though sparse, has greatly reduced the rates of lateral expansion in the last 20 years. Roadside gullies along the steeper segments of county roads have in most cases, ceased to deepen because of the relatively shallow depth to rock. However, the sides of these gullies remain denuded of any vegetation as a result of periodic grading that constitutes the maintenance program for these roads. Though these gullies represent a visual blight on the aesthetic aspects of the watershed, they do not compose a significant source of sediment.

In past years, erosion from oil-waste areas produced a large portion of the sediment but has presently diminished greatly with the decrease in drilling activities and the stabilization of the old eroded areas on rock or heavy clay subsoils. Erosion on these areas has affected about 475 acres in the watershed, on which from 6 to 24 inches of soil has been removed. These areas, like the roadside gullies, are eyesores on the appearance of the landscape, but are no longer critical sediment sources. Annual gross erosion from all sources is approximately 1.32 acre-feet per square mile.

Flooding has caused sheet and gully scour damage on 54 acres of the floodplain. The sheet scour has removed from 4 to 12 inches of topsoil from some areas in bottom land fields while gully scour has cut channels from 12 to 24 inches deep, 10 to 20 feet wide, and up to 200 feet in length in the flood plain. In addition to the loss of soil fertility

caused by this scour, these areas also suffer decreased productivity from the impairment of surface water drainage from these areas. Measured by reduced productivity, damage ranges from 20 to 30 percent. During the past few years, floodplain scouring has decreased. This decrease has resulted from changes in land use, the adoption of conservation practices, and the establishment of vegetative cover on land placed in the Conservation Reserve. Erosion damage amounts to an annual monetary damage of \$1,180.

Sediment Damage

Sediment produced by accelerated erosion has been deposited on the floodplain by floodwater since the first field was broken to cultivation in Territorial days, probably around 1890. In early years, when the sediment resulted from the erosion of topsoil, the deposition was not damaging and may have even been beneficial. In later years, when the topsoil was gone and the infertile subsoil and parent material had become exposed on upland areas, the sediment deposited on the floodplain began to result in damage in the form of reduced productivity. Eventually the sediment damage, in conjunction with floodwater damage, caused a change in use of much of the floodplain from cultivated crops to pasture.

Damage by sediment deposition on the floodplain of Turkey Creek ranges from slight to moderate. A total of 302 acres, about 13 percent of the total floodplain, has been damaged by deposits of silty sand ranging in depth from 6 inches to two feet. Damages are estimated to range from 20 to 30 percent in terms of reduced productivity.

Sediment yield at the mouth of the watershed is presently about 20 acre-feet per year. About 12 acre-feet of this total are estimated to be delivered eventually to the Eufaula Reservoir. This represents an annual monetary damage of \$570.

A study of suspended sediment at the mouth of the watershed showed an average annual concentration of 1,265 ppm under present conditions.

Burning of trees and grass cover has not been a major problem. Educational programs showing the detrimental effects of burning have been effective in preventing fires. These programs have been supported by the schools, towns, extension service, and Conservation Districts.

Drainage

Drainage is not a problem since there is no inherently wet land in the watershed. Farm drainage and some land leveling may be needed on areas where surface drainage is inadequate.

Irrigation

There is a need for supplemental irrigation during drouth periods. There are presently no existing irrigation systems in the watershed. Sediment pools will provide limited supplemental supply for irrigation; however, because the quantity is not dependable, and future quality is questionable, most landowners will not make the necessary expenditure to develop a system. No interest was shown during planning to add additional storage for irrigation.

Municipal and Industrial Water

At present there is not a demand for municipal or industrial water. During the early stages of planning, some interest was shown in developing municipal and industrial water in site 5 by the small town of Earlsboro located two and one-half miles to the southwest. Investigations showed water quality in the area to be highly questionable for municipal uses. Earlsboro sought and obtained a suitable supply elsewhere thus eliminating the only expressed interest in additional water supply.

Topography limitations and the small drainage areas above structures limit the potential for surface water development.

Good potential exists for development of ground water. Sandstones and conglomerates of the Vamoosa and Vanoss formations produce water of generally good quality. The municipal supply for the City of Seminole is presently supplied from this ground water reservoir.

Recreation

Recreation needs in the watershed are not significant in view of the relatively sparse rural population and the existence of other water based recreation facilities within a fifty mile radius of the watershed, including Shawnee Lake, Lake Thunderbird, Lake Stanley Draper, Lake Eufaula, and numerous flood prevention structures.

Fish and Wildlife

Wildlife habitat in the watershed has improved steadily with the retirement of land from cultivation and the improvement of cover conditions through the application of conservation practices, but is in need of further improvement. Woody cover occurs mostly in narrow bands along the creeks and drainageways, varying from sparse to dense and consisting mainly of elm, cottonwood, ash, pecan, post oak, blackjack oak, hackberry, sumac, and gray stem dogwood.

There is practically no fishing in the upper reaches of Turkey Creek due to the intermittent nature of the stream. A pool at the lower end of Turkey Creek provides moderate amounts of fishing to local residents.

Additional fish and wildlife habitat is needed. There are no endangered species in the watershed.

Economic and Social

The 1969 Census of Agriculture for Oklahoma reports that 42 percent of the 944 farms in Seminole County had farm sales of less than \$2,500 in 1969. The proportion of low income farm units in the watershed would be comparable to this percent for Seminole County.

The counties in which the watershed is located are not eligible for assistance at this time under Title IV of the Public Works and Economic Development Act. However, in 1972 the counties were listed by the Manpower Administration of the U. S. Department of Labor as counties having substantial unemployment equal to 6 percent or more of the work force. The Seminole County unemployment rate in 1969 was 4.3 percent. Employment opportunities fluctuate with the overall economic conditions within the State and Nation. The opportunities for off-farm employment of people desiring this type of employment appear to be adequate. In addition to the operator, farms require only seasonal employment.

It is estimated that no more than 5 percent of the farms or ranches in the watershed require 1-1/2 man-years or more of hired labor.

People within the watershed respond well to meetings that are to the interest of the community. There is no established community center; however, there is one school and one church that provide a place for community activities.

Other

Water for livestock and rural domestic use is supplied from farm ponds, wells, and from stream flow. Well water is obtained from sandstone at depths of 50 to 100 feet on upland areas. Water is obtained from wells in the alluvium at depths of 20 to 50 feet.

PROJECTS OF OTHER AGENCIES

Eufaula Reservoir

Eufaula Reservoir was constructed under the supervision of the Corps of Engineers, U. S. Army, Tulsa District. The dam site is located on the Canadian River approximately twelve miles east of Eufaula, Oklahoma. The upper limit of the flood pool is about 70 miles downstream from the mouth of Turkey Creek. The project is for flood control, hydro-electrical power, navigation, recreation, and fish and wildlife purposes. The effects of measures included in the Pott-Sem-Turkey Watershed work plan, though minor, will be integrated into the overall plan for the basin.

PROJECT FORMULATION

Project formulation is based on the need for a project to reduce flood damages to agricultural production and nonagricultural properties, reduce sediment, reduce the destruction of land by erosion, enhance property values, advance the welfare of the owners and operators of the agricultural properties, and promote the economic growth of the area.

When planning activities were authorized, the Soil Conservation Service mailed an announcement to all concerned Federal and State Agencies that a Watershed Work Plan was to be developed for the Pott-Sem-Turkey Creek Watershed. This announcement invited each agency to participate and make contributions to the plan.

A biological reconnaissance of the watershed was made by personnel from the Oklahoma Department of Wildlife Conservation, United States Fish and Wildlife Service, and the Soil Conservation Service. Wildlife habitat considerations and mitigation measures discussed in the biological reconnaissance report were included in work plan development.

When the proposed plan for structural measures was completed, a meeting with a sites approval committee to represent the sponsors and the Watershed Planning Staff was scheduled. A large watershed map showing the location of each floodwater retarding structure was displayed at this meeting. Using the site topography maps, aerial photos, road profiles, and other data, each site was discussed in detail. The sediment pool and detention pool contours for each site were drawn in color on the 4-inch to the mile aerial photos. Using these photos, the land involved with the pools was identified and land rights requirements outlined. Road and utility modifications were also discussed. Site committee approval for each of the eleven individual sites was given.

The sites committee then passed a resolution that the eleven sites proposed and evaluated by the Watershed Planning Staff be included in the work plan.

A public hearing was scheduled to present the proposed plan, answer questions and inform the public that all suggestions and comments should be submitted in writing to the local sponsoring organization.

Invitations to attend the public hearing were mailed directly to two County Agencies, eleven State and nine Federal Agencies, two other organizations, and fifty landowners and farm operators.

A notice of the meeting also appeared in the Wewoka, Oklahoma, Daily Times newspaper on Tuesday, January 11, 1972.

Representatives from two County, one State, and three Federal Agencies and 13 landowners were present at the public hearing on January 18, 1972.

Only one letter of protest concerning the location of one floodwater retarding structure was received.

A coordinated plan identified as the Central Oklahoma Project has been investigated by the Corps of Engineers. This study covered extending navigation from the Arkansas River to the vicinity of Oklahoma City and McAlester, and for the diversion of water from tributaries of the Red River in southeast Oklahoma to the vicinity of Oklahoma City. The effects of measures included in the Pott-Sem-Turkey Watershed work plan, though minor, will be integrated into the overall plan for the basin.

Objectives

Flood problems, watershed protection, and water management needs were examined by the local sponsors and the Soil Conservation Service. It was agreed by the sponsors and the Service to plan a project that would accomplish the following objectives:

1. Develop conservation plans on at least 80 percent of the farms and ranches in the watershed. Through these plans landowners and operators will be encouraged to use the land within its capabilities and to carry out treatment according to its needs for protection and improvement of the soil resources. These measures applied at an accelerated rate will be effective in reducing soil erosion, improving soil fertility and increasing the productivity of the cropland and grassland in the watershed.
2. Plan a system of water flow control structures to supplement these land treatment measures and provide a reduction of 70 to 80 percent in average annual floodwater and associated damages to the agricultural floodplain lands. Accomplish this reduction with a minimum encroachment on good agricultural land.
3. Develop all feasible multiple purpose structures for which sponsors are available.
4. Provide a habitat condition which will preserve, improve and perpetuate wildlife resources. Manage sediment pools for fish, wildlife and waterfowl under going and accelerated programs in conjunction with the Oklahoma Department of Wildlife Conservation.

5. Preserve, enhance, and develop for the edification and gratification of society all historical, cultural, archeological, ecological, scientific, and unique scenic resources.
6. Result in a watershed which will be an outstanding example of soil and water conservation.
7. Improve the economic conditions of low income farm families and rural communities.

The needed land treatment measures, based on current needs, which remain to be applied in the watershed were used in project formulation. Although significant benefits would result from application of these needed land treatment measures, it was apparent that structural measures would be required to attain the degree of watershed protection and flood damage reduction desired. Selection of these structural measures was based on the least costly system to meet project objectives.

The size and location of the floodwater retarding structures were influenced by the level of protection needed to meet project goals; by obstructions such as highways, county roads, farmsteads, utility lines and oil field development; the location of floodplain areas needing protection.

The proposed floodwater retarding structures were evaluated for recreational potential. Due to the low projected need for recreation in the area, the small size of the pool areas, and lack of scenic surroundings at site locations, it was determined that no significant public recreational potential exists at these sites.

Water storage needs for fish and wildlife and irrigation uses were recognized and considered. No sponsors were available for either of these purposes.

The land treatment measures and eleven floodwater retarding structures will adequately solve the watershed problems and most nearly meet the project objectives. The plan will be developed to complement programs of other agencies and is flexible for adjustment to permit ultimate development of the full water resources of the area.

Drainage needs can be met by on-farm drainage systems for which suitable outlets are available, therefore, there is no need for drainage being a project purpose.

The first alternative considered was a program of land treatment measures alone. This program is identical to that included in the section on Works of Improvement to be Installed. This alternative would be effective in reducing upland erosion about 20 percent but would result in a reduction of only about 5 percent in floodwater damages.

Landowners and operators in the floodplain would be forced to maintain the land use in pasture as a result of continuing flood risks. The commitment of 1,290 acres of land to dams, spillways, and pool areas and the destruction of or damage to 18 archeological sites would be avoided by this alternative. The estimated cost of land treatment alone is about \$214,800.

The second alternative considered was that of land treatment and channel enlargement. A channel with sufficient capacity to provide approximately the same level of protection as the selected project would cost about \$1,225,000. The effects in reducing flooding will be essentially the same as those produced by the project proposal. Land conversions and loss of archeological resources resulting from installation of floodwater retarding structures would be avoided by this alternative. Construction of the waterflow channel with its attendant spoil banks would result in the loss of 55 acres of potentially productive agricultural floodplain land and about 10 acres of wildlife habitat immediately adjacent to the present channel.

The third alternative considered was that of land treatment, combined with flood-proofing of fixed floodplain improvements and acquisition of high risk floodplain areas. The land treatment program would be identical to that in the proposed project in both effect and cost.

One of the flood-proofing features of this alternative would involve about four miles of roads and about 15 bridges in the watershed which are subject to flood damages. The estimated cost of raising the affected roads and bridges above flood levels would total about \$250,000. Another floodproofing feature would involve replacement of conventional multiple-strand barbed wire or woven wire fences by single strand electrified fences with electrical sources located above flood levels. These single-strand fences would be less susceptible to damage as well as easier and more economical to repair. The cost of replacing about 55,000 feet of existing fences in the floodplain area with single-strand electrified fence is about \$12,500.

Buildings located in the floodplain would also require floodproofing. These are mostly pole-frame shelters for farm implements, livestock, or hay having dirt floors, with roofs and walls of corrugated metal. Since the principal cause of damage to these buildings is the force of floodwater against the walls, and since their principal function is for overhead protection from the weather, the buildings could be open on the sides perpendicular to the direction of floodwater current. However, the contents of the buildings could be protected only by raising the floors above flood levels. The use of earth fills within concrete retaining walls, with ramps to permit access of machinery or livestock, would provide protection to both the building and its contents. The estimated cost of modifying 12 such structures is \$30,000.

The acquisition of about 1,700 acres of floodplain land within the area flooded by a two-year frequency storm was considered to be a necessary part of this alternative. This area would be fenced to exclude livestock. The estimated cost of acquiring the land, and fencing it is \$850,000.

The total estimated cost of the combined features of this alternative is \$1,356,500. The effects of this alternative would include a reduction of flood damages by about 65 percent, a reduction of upland erosion by about 20 percent, the virtual elimination of livestock losses from flooding and the avoidance of land commitment in dams, spillways, and pool areas. The archeological sites in floodwater retarding structure sites would also remain undisturbed. The land acquired for public use will result in loss of agricultural production on 1,700 acres. This loss of agricultural production would economically displace approximately five farm families.

The fourth alternative considered was that of land treatment combined with a floodway. The land treatment program would be identical to that in the proposed project. The floodway would require the commitment of about 250 acres of agricultural land and about 75 acres of bottomland hardwood areas along the present stream channel. The costs of land acquisition and construction for this alternative are estimated to be about \$950,000. Total cost, including land treatment, would be about \$1,164,000.

This alternative would provide about a 60 percent reduction in flood damages and a reduction of about 20 percent in upland erosion. The commitment of 1,280 acres to dams and spillways would be avoided, as would the disturbance of the archeological sites involved in floodwater retarding structures. However, production would be lost on the 250 acres of agricultural bottomland required for the floodway and 75 acres of bottomland hardwood wildlife habitat would be lost. The fish habitat and watering places for livestock and wildlife that would be provided by the structures would be eliminated.

The fifth alternative considered was that of no project action. With no action, floodwater damage would continue. The going land treatment program would accomplish the objectives of the planned 5-year accelerated land treatment program in about 10 to 15 years. Land use in the floodplain would remain in low value pasture. Average annual net benefits of \$32,467 would be foregone by this alternative.

WORKS OF IMPROVEMENT TO BE INSTALLED

Land Treatment Measures

An effective conservation program based on the use of each acre of agricultural land within its capabilities and its treatment in accordance with its needs, such as is now carried out by the Seminole County Conservation District, the Shawnee Conservation District, and the Land Operations Work Unit Offices of the Bureau of Indian Affairs, is necessary for a sound watershed protection and flood prevention program. Basic to reaching this objective is the establishment and maintenance of all applicable soil and water conservation and plant management practices essential to proper land use. The sponsoring districts have agreed to accelerate the establishment of land treatment practices which have a measurable effect on the reduction of floodwater, sediment, and scour damages.

The Soil Conservation Service and Bureau of Indian Affairs will, as needed, assign additional technicians and aids to assist landowners and operators cooperating with the soil conservation districts.

Technical assistance in the land treatment program will consist of soil surveys, resource inventories, development of conservation plans on individual farms, consultative assistance and technical services in the installation of land treatment measures.

Land treatment for the area above floodwater retarding structures is important for protection of the watershed. This land treatment will allow the structural measures to function more efficiently by reducing runoff and sediment delivered. Land treatment constitutes the only planned measures for the protection of upland areas.

Land treatment measures to be installed on cropland will be a combination of conservation cropping systems, contour farming and crop residue management. Crop residue management will be an essential measure to be applied.

Land treatment measures to be installed on pastureland will be a combination of pasture and hay management, pasture and hay planting, ponds, and critical area planting. For rangeland, the measures to be installed will be deferred grazing, proper grazing use, brush control, and ponds.

The Conservation Districts will plan and recommend to landowners and operators that they leave and protect forest land on the thinly-soiled ridgetops and the steeper slopes adjacent to the floodplain. The Oklahoma Forestry Division will provide the technical assistance necessary to help the landowners develop a detailed forest management plan for his woodlands. Such a plan will direct the optimum development

of all the potential resource values of the owner's woodlands. The Forestry Division, under the going Cooperative Forest Management programs, is already offering such forestry management assistance, making tree planting stock available and providing extensive forest fire protection to private landowners within the watershed. Preserving these remaining forested acreages will not only conserve the water related capabilities of the land, but also enhance the other environmental factors of the forest such as wildlife habitat, recreational resources, aesthetics and climate influences, among others.

Alternative combinations of land treatment measures to be installed on cropland, pastureland or rangeland will depend upon the needs of the land operator in combination with soil capability and soil management problems. Field Office Technical Guides will be used in planning the various alternatives of land treatment measures needed.

The construction of forty farm ponds, with 301 ponds already in use in the watershed, will provide watering places for livestock and wildlife. A concerted effort will be made to interest district cooperators in fishpond management and fishpond stocking through the cooperation of the U. S. Fish and Wildlife Service and the Oklahoma Department of Wildlife Conservation.

The estimated cost of land treatment measures that will be installed by landowners and operators during the five-year installation period are shown in Table 1.

Structural Measures

A system of eleven single purpose floodwater retarding structures will be installed to protect floodplain land that cannot be adequately protected by land treatment measures alone. The combined drainage areas of these proposed structures comprise 49 percent of the watershed. The structures will have a total floodwater detention capacity of 6,095 acre-feet and will detain temporarily an average of 4.35 inches of runoff from the watershed area controlled. Floodwater retarding structures numbers 1 thru 9 and number 11 are planned to detain temporarily the direct runoff from a 25-year frequency, 10-day storm period. Structure number 10 will temporarily store runoff from a 50-year frequency storm of the same duration.

Principal spillway conduits are to be reinforced concrete pipe with a minimum diameter of 18 inches. There is sufficient capacity in all structures to permit the use of vegetated emergency spillways.

All structures will involve the use of earthfill embankments. Preliminary geologic investigations made on all proposed sites indicate that sufficient borrow material is available in the sediment pool areas. No additional land rights will be needed as a source for borrow material.

One hundred and eight acres of forested area will have to be cleared within the 297 acres surface area of the sediment pools.

Sites located in the Konawa Formation are not expected to have rock in the emergency spillways. Sites 8, 9, and 10, located in the Vanoss and Ada Formations, are expected to have 30 to 60 percent rock excavation in the emergency spillways. Total rock excavation in these three sites is estimated to be 300 cubic yards.

Contractors installing the structural measures will be required to adhere to strict guidelines for minimizing soil erosion, water and air pollution during construction. Such practices as the use of hay or other type mulches and/or temporary vegetation to minimize wind and water erosion, and controlled burning to comply with state standards will be included in the construction contract. Plans for stabilization measures such as sodding or other treatment during or immediately following construction will also be a part of the construction contract.

Where possible, construction completion will coincide with a favorable season for establishment of vegetation.

As a result of a field survey, a professional archeologist has recommended that archeological resources at structure sites 4 and 7 be further investigated prior to disturbance by construction activities. The total cost of this work is estimated to be approximately \$1,600. The National Park Service has been designated as the responsible agency for the salvage or preservation of archeological materials by Public Law 86-523. The Soil Conservation Service will provide information showing the site locations, approximate areas to be flooded, approximate areas to be disturbed, approximate schedules of construction and other pertinent data to the Secretary of the Interior for use in determining the course of action to be pursued.

All collection and salvage of data and materials will be performed as expeditiously as possible with a minimum of disruption and delay to the functions of the Soil Conservation Service in its administration of Public Law 83-566.

Provision is made at all sites for 100-year sediment storage. The crest of the principal spillways will be set at the 50-year sediment storage elevation. Storage of water to the 100-year sediment storage elevation may be allowed where water rights are obtained to add the second 50-year sediment storage. Storage of water to the 100-year sediment storage elevation will be handled on a site-by-site basis when land rights are obtained.

Potential for low intensity recreational use of all sites except site 5 was recognized and discussed with local sponsors. Public access to these areas is not provided for in this plan. Land rights agreements with individual landowners will stipulate that if, in the future, public access to any of these areas is allowed that sanitary facilities approved by the Oklahoma State Health Department will be provided.

The habitat destroyed by structural measures is principally grassland with some areas of bottom land hardwoods bordering stream channels. These areas provide food and cover to such species as rabbits, squirrels, quail, songbirds, and an occasional deer.

Wildlife plantings and measures to minimize damages to habitat caused by the installation of structural measures will be made as follows:

1. Selected plantings of legumes, shrubs, and trees will be made at floodwater retarding structure sites 1, 3, 4, and 8 to provide food and cover habitat for wildlife. Plantings will be made on areas of from one-half to three acres and these will be fenced to prevent grazing or trampling by livestock.
2. Wildlife habitat plantings will be established along fence rows in odd areas, corners, gullies, ditches, and eroded areas.
3. Brush shelters to improve cottontail habitat will be constructed at each site with brush and timber obtained as a result of the clearing operations.

Final determination with regard to exact quantities and locations of wildlife plantings will be determined at the time of structural measure installation.

Land rights for all structural measures will be furnished by local interests. Approximately 237 acres of bottomland and 60 acres of upland will be in the sediment pool areas. An additional 177 acres of bottomland and 706 acres of upland will be inundated temporarily by the detention pools. Present land use in the pool areas is in forestland, rangeland, and pastureland. Another 110 acres will be involved in dams and spillways, making a total area of 1,290 acres directly involved in floodwater retarding structures.

The local sponsoring organizations will also be responsible for relocating, rebuilding or modifying existing facilities or properties as follows:

<u>Item</u>	<u>Structure Number</u>
Utility Line	1 and 10
County Road and/or Bridges	2 and 3

Prior to selection of final site locations, site committees representing the sponsoring organizations made on-site investigations and studied the problems involved. Investigations have determined that the present site locations will not result in the displacement of any person, business or farm operation. These site locations were approved in formal meetings of these committees.

Tables 1, 2, and 3 give details on quantities, cost and design features of the structural measures. The project map (Figure 2) shows the location of the structural works of improvement, Plate 1, a schematic drawing of a structure, is typical of the eleven floodwater retarding structures included in the project.

This project plan conforms to all Federal, State, and Local laws and regulations and will have no known detrimental effect on any downstream projects now in place or that might be constructed in the future. The sediment pool design of all floodwater retarding structures will conform with Oklahoma Planning and Resources Board Resolution dated January 10, 1961.

EXPLANATION OF INSTALLATION COSTS

The installation cost of the entire project is estimated to be \$1,312,256, of which \$899,124 will be paid from Public Law 566 funds and \$413,132 will be borne by other funds. Total costs figures include funds for land treatment measures, \$214,833, and structural measures, \$1,097,423 (Table 1).

Land Treatment

Public Law 566 funds will include \$17,850 to provide technical assistance during the 5-year installation period, to accelerate the installation of land treatment measures included in the plan for watershed protection. These funds will be in addition to \$13,300 provided under existing programs. Landowners and operators will install these measures at an estimated cost of \$181,334 which includes ACP payments based on present program criteria (Table 1).

The Forestry Division, under the going Cooperative Forest Management programs will provide technical assistance as needed. The estimated cost of these services is \$500.

It is estimated that \$404,719 in costs and services have been expended to date by the local people in the application of conservation practices on the watershed (Table 1A).

Floodwater Retarding Structures

The construction cost of the eleven floodwater retarding structures (\$635,645) with associated engineering services costs (\$83,792) and a portion of the project administration cost (\$161,837) will be borne by Public Law 566 funds (Table 2). The total Public Law 566 cost for the installation of these structures is \$881,274. Construction costs include the engineer's estimate and contingencies. The engineer's estimate was based on the unit cost of structures in similar areas modified by special conditions inherent to each individual site. Wildlife plantings and measures to minimize damages to habitat by the installation of structural measures are to be installed at sites 1, 3, 4, and 8. Estimated costs of \$1,200 for these plantings are included in the construction costs.

Special features considered were embankment drainage, slope protection, timber clearing, rock excavation, and release flow channels. These costs were based on data obtained by surface observations and shallow borings on all the sites. Twelve percent of the engineer's estimate was added as a contingency fund to provide money for any unpredictable construction costs.

Local sponsors costs are estimated at \$210,749 (Table 2). These consist of the value of land easements, \$195,189; modification of utilities and roads, \$12,200; and legal fees, \$3,360. Modification of county roads and bridges will be needed at two locations (estimated costs, \$1,800). Modification of utility lines will be needed at two locations (estimated costs, \$10,400). The local costs were based on

estimates provided by local sponsors, real estate operators, and local representatives of other agencies. The National Park Service will provide \$1,600 for archeological salvage at sites 4 and 7.

Relocation of any person, business or farm operation is not expected. If relocations become necessary, relocation payments will be cost-shared in accordance with the percentages shown in the Work Plan Agreement.

Project Administration Costs

Soil Conservation Service project administration costs of \$161,837 for the structural measures include \$18,033 for administration and overhead, and \$141,004 for construction inspection. Project Administration costs of the Bureau of Indian Affairs for engineering and technical services are \$2,800. Other costs of \$3,800 cover local sponsor costs during construction.

Schedule of Obligations

The following table is an estimated schedule of funds for the 5-year project installation period and covers land treatment and structural measures:

Fiscal Year	: Public Law 566 Funds :		: Other Funds :		Total
	: Land Treatment:	: Structural:	: Land Treatment:	: Structural :	
	Measures	Measures	Measures	Measures	
	(Dollars)	(Dollars)	(Dollars)	(Dollars)	(Dollars)
1	3,570	44,100	39,396	10,700	97,766
2	3,570	265,000	39,396	64,400	372,366
3	3,570	265,000	39,396	65,600	373,566
4	3,570	220,300	39,396	54,000	317,266
5	3,570	86,874	39,399	21,449	151,292
TOTAL	17,850	881,274	196,983	216,149	1,312,256

This schedule may be adjusted from year to year on the basis of any significant changes in the plan found to be mutually desired and in the light of appropriations and accomplishments actually made.

EFFECTS OF WORKS OF IMPROVEMENT

Flood Prevention, Erosion, and Sediment

Agricultural benefits accruing to this project are based on reduction of damages on 2,564 acres below proposed floodwater retarding structures.

Land treatment will have a significant effect in reducing floodwater and sediment damages on floodplain lands. The application of a conservation and land treatment program will increase farm income and result in a better standard of living for farm families.

An accelerated land treatment program will reduce present condition runoff of the 100-year frequency storm from 6.13 inches to 5.82 inches, causing a reduction in flooding from 2,564 acres to 2,436 acres. After installation of the total project, the area inundated will be further reduced to 1,981 acres. Average annual flooding with the project installed will be reduced from 2,252 acres to 813 acres.

The reduction in flooded acres will reduce the average annual direct and indirect floodwater damages 78 percent.

Listed below are comparative data for cross-section 5, located approximately 0.4 mile above State Highway 99 (See Figure 1).

	Storm Frequency			
	2-Year		10-Year	
	Without	With	Without	With
	Project	Project	Project	Project
Peak Flow (CFS)	4,400	2,450	8,000	4,250
Elev. (Ft.)	900.7	898.7	902.2	900.6
Acres Flooded	85	21	112	80

The major crops being grown on the floodplain, under present watershed conditions, are alfalfa, small grains, and grain sorghums. About 50 percent of the floodplain is in pasture use. It is estimated that with the project installed, pasture use of the floodplain will be reduced to 25 percent, and alfalfa, grain sorghums, and small grains increased.

Approximately 50 owners and operators of floodplain lands will be directly benefited by reduced flood damage as a result of the structural measures. The reduced flooding will give farm operators the incentive to restore the floodplain land to crops capable of providing higher net returns. It is estimated that alfalfa hay and improved pastures will be the primary sources of enhanced profits following project installation.

Processors of agricultural products and businesses selling supplies to those engaged in agricultural production will be indirectly benefited by the project. Average annual damages to the road and bridge system within the watershed will be reduced from \$22,440 to \$5,740.

The total area subject to premanent or intermittent inundation above floodwater retarding structures is about 1,180 acres. Of this total, 466 acres are reserved for sediment storage over the project evaluation period. These sediment reserve areas are expected to fill with water and provide a variety of beneficial uses until sediment accumulation gradually reduces the reserved storage.

The sediment pools will have numerous beneficial uses for wildlife, agricultural and non-agricultural water management, pollution abatement, and environmental betterment. The intermittently inundated areas above the structures, reserved for floodwater storage to be released at an established rate, can be developed and used for pasture.

Approximately 110 acres of land now in forestland, pasture, rangeland, and creek channels will be temporarily removed from agricultural use during construction of the dams and spillways. Tame grasses will be planted on most of these areas, with some of the fenced areas of sites 1, 3, 4, and 8 devoted to food and cover plantings designed specifically for wildlife use.

The project will be beneficial to the control of mosquitoes and other disease vector insects.

Due to project installation, the monetary output of the agricultural sectors will be increased by about \$37,000 annually. Personal income will be increased by an estimated \$15,000 annually. An analysis of project benefits indicate that agricultural employment on a long-term basis will be increased by two people, and total employment by four people.

The project will create additional employment opportunities. The firms contracting for installation of floodwater retarding structures will hire skilled and unskilled labor from the immediate locality. The operation and maintenance of the project measures over the life of the project also will provide employment opportunities for local residents.

Secondary benefits, including increased business activity and improved economic conditions in the surrounding communities, will result from project installation.

Soil loss from upland in the watershed will be reduced by land treatment measures from 72 acre-feet to 66 acre-feet annually, a decrease of 20 percent. Sediment yield at the mouth of the watershed from all sources will be reduced from the present rate of 20 acre-feet to 9 acre-feet annually by the complete project. Floodplain erosion presently accounts for approximately 4 percent of the annual gross erosion in the watershed and about 5 percent of the total sediment yield at

the mouth of the watershed. Sediment yield to Eufaula Reservoir with the project will be reduced approximately 6 acre-feet annually. With the project, the concentration of suspended sediment at the mouth of the watershed would be reduced by approximately 48 percent. Even though this damage exists and can be reduced with the project, it was not used as a monetary benefit.

Due to the small areas affected by the sites, petroleum exploration and production activities will be essentially unaffected in the site areas. However, these activities which occur below the sites will be benefited due to reduced flooding. The reduction in flooding will also reduce the amount of pollution by oil and brine which has occurred in the past when these facilities have been flooded.

The 50-year sediment pools for the proposed structures in the Pott-Sem-Turkey Watershed work plan have a combined initial surface area of 297 acres. Plate 2 in the U. S. Department of Commerce Weather Bureau Technical Paper Number 37 indicates a mean annual lake evaporation of approximately 59 inches for the Pott-Sem-Turkey Watershed while the nearest U. S. Weather Bureau precipitation station at Shawnee has a long term average annual rainfall of 37.22 inches. This results in a net annual evaporation loss of 21.78 inches (59.00 minus 37.22 inches) from the surface of the lakes. Assuming that the lake pools were always full, a net evaporation loss of 21.78 inches on 297 surface acres would result in an average annual evaporation loss of 539 acre feet. Average annual runoff maps for the 1931-1960 period developed by the U. S. Geological Survey and published by the Oklahoma Water Resources Board indicates that the average annual runoff would be about 5.5 inches or 15,840 acre-feet from the 54.0 square miles of drainage area in the Pott-Sem-Turkey Watershed. The 539 acre-feet of lake surface evaporation loss annually would represent a 3.4 percent reduction in water yield from the project area. With the exception of those isolated reservoirs where water rights are obtained to store water up to the 100-year sediment pool elevation, the reduction in yield will decrease from 3.4 percent immediately after construction to zero at the end of 50 years as the sediment pools are filled with sediment.

No published sources of water quality data are available for the Pott-Sem-Turkey Watershed. Water quality in the upper reaches of the stream system has been impaired by activities related to oil production.

Water quality data on other streams in the area, such as Wewoka Creek, show high mineral content and dissolved solids. The mineral content is due primarily to salt (sodium chloride), much of which comes from oil-field brines. High-flow or storm-flow water generally contains small amounts of dissolved minerals and is of a good quality.

When the planned project has been completed, quality of water below the structures will be improved by a reduction of solids present in the streamflows. This reduction will result from proper land treatment and the trapping of sediment by structures. Quality of water impounded in

structures will vary from site to site. Water in the sediment pool of Site 5 is expected to be of poor quality. Oil production above the site has produced salted-out areas. Several old oil wells are still in production and one new well is being drilled.

Oil production in other areas of the watershed is limited and should have little effect on stored water. However, it is expected that water quality will gradually deteriorate in all structures over the years as water is replaced by trapped sediment.

The flood protection provided by the proposed project may bring about more intensive use of the cropland and pastureland in the flood plain. One facet of this land use may be increased application of fertilizers and pesticides. Application rates will be influenced more by future economic conditions than by the fact that flooding will be reduced.

Present scientific know-how does not permit exact quantification of water quality changes caused by the use of agricultural chemicals; however, some of the facts relevant to this question are listed below:

1. There is evidence that sediment plays a major role in transporting some agricultural chemicals. 1/ Sediment yield at the mouth of the watershed will be reduced about 55 percent.
2. Some nutrients are transported in solution by overbank flows. This project will considerably reduce the number of severity of overbank flows. The average annual cumulative acreage of flood plain inundated will be reduced by about 64 percent.
3. Legal restraints on the use of long life pesticides will continue to bear upon the use of undesirable chemicals in the watershed.

The possibility of eutrophication of the stream system resulting from the potential enrichment of nitrogen and phosphorus fertilizers has been considered. Published reports on the subject point out that "Enormous growth of plants in streams and lakes does not occur if the nitrate as N is kept below 0.3 mg/l and the total nitrogen as N is below 0.6 mg/l. 2/ The range of nitrate concentrations at the nearby Hog Creek water quality station was from 0.0 to 7.1 mg/l, while the weighted concentration was well above 0.6 mg/l. Data on phosphate concentrations was not available. Not only must nitrogen and phosphorus be present in sufficient quantities and in the proper chemical forms, they must also be present in the proper proportion. A common nitrogen-phosphorus ratio of approximately 30:1 is required to promote an algal bloom while the ratio for specific algal forms may vary from 15:1 up to 50:1. In addition to the nitrogen-phosphorus ratio, algae growth is also controlled by trace mineral requirements, water turbidity, temperature, etc. Plankton growth was reported to be 13 times more abundant in

1/ Agricultural Research Service report at the joint SCS-ARS Southern Regional Workshop, Chickasha, Oklahoma, Jan. 31-Feb. 1, 1974.

2/ Muller, W., "Nitrogen Control and Pollution of Streams", Water Pollution Abstracts No. 29, 454(1955).

clear, and 1.5 times more abundant in moderately turbid waters than in muddy Oklahoma ponds. 1/

Algal growth at present is not an apparent problem in the Pott-Sem-Turkey Creek Watershed. A very limited amount of research data is available on the effects of increased fertilizer usage. The following data collected by the Agricultural Research Service from July 1972 through June 1973 was extracted from a paper presented at the American Society of Agromony meeting in Las Vegas, Nevada, in 1973:

<u>Water-*</u> <u>shed</u>	<u>Area</u> <u>Ac.</u>	<u>Land</u> <u>Use</u>	<u>Ferti-</u> <u>lizer</u>	<u>Total</u> <u>Surface</u> <u>Runoff</u> <u>(Inches)</u>	<u>Weighted Mean Concentrations</u>		
					<u>Nitrogen</u> <u>TKN</u>	<u>Phosphate</u> <u>Soluble</u>	
						<u>Total</u>	<u>Ortho</u>
C-1	17.8	dryland cotton	Never**	7.4	3.29	0.54	0.49
C-2	44.3	irrigated cotton	Yes	9.4	3.44	0.90	0.81
C-3	29.9	irrigated cotton	Yes	9.8	3.96	0.68	0.71

* All plots are located on similar flood plain soils which are primarily McLain Silt Loam or Reinach Silt Loam.

**Plot C-1 has no history of fertilizer application.

From these analyses it may be concluded that the natural fertility of these plots is relatively high. Although not apparently significant, some increases in nutrient levels do occur in runoff from the irrigated, fertilized plots. It is not known how much of the increases are caused by fertilizer additions. It is apparent that the runoff is increased by irrigation on fields C-2 and C-3.

Based on known data, the proposed project is not expected to have significant adverse effects on downstream water quality. Due to the type of geologic formations in the site vicinities there may be some groundwater recharge in the immediate site areas. However, due to the lenticular nature of the interbedded sandstones and low permeability of intervening shales, lateral water movement will be restricted to local areas. Consequently, completion of the planned project will have little affect on the water table of the watershed as a whole.

Fish and Wildlife

Within the project, 297 acres of moderate to good habitat for terricolous wildlife and birds will be changed to aquatic habitat in areas reserved for sediment storage above floodwater retarding structures. An additional 883 acres will be subject to temporary inundation during periods of excessive runoff and 110 acres will be occupied by dams and spillways.

1/ Fichter, G. S., "Clear Waters-Good Fishing", Oklahoma Game and Fish News, 11:5,3(1955).

Most species of wildlife frequenting these areas, i.e., squirrels, rabbits, quail, and deer, are very mobile animals and tend to utilize the areas largely as feeding areas and for escape cover. It is anticipated that the primary land use of the areas immediately below the structures will not change significantly. Any increased clearing of timber would probably result in either alfalfa or feed crops. These crops would tend to offset the adverse effects to wildlife if any clearing did occur.

The average farm size in Seminole County is 295 acres and this is typical of farms in the watershed. Average field size is less than 50 acres. Most clearing of timber would be on tracts much smaller than 50 acres and the majority of ecotonal habitat would not be destroyed. The quality of plants established would be an improvement over most pasture plant species.

Installation of the mitigation measures will compensate for the loss of wildlife habitat. Incorporation of other wildlife recommendations would enhance fish and wildlife habitat.

The sediment pool of Site 5 may have some pollution as a result of runoff from salted-out areas around oil wells that will reduce optimum fish productions. However, the pools of the remaining sites will contain good quality water and provide potential development of fishery resources.

Archeological, Historic, and Scientific

Of the 25 archeological sites identified in the vicinity of floodwater retarding structures, only two will be inundated in sediment pool areas. An additional nine sites will be inundated periodically in the flood pool areas and subjected to occasional wave action. Seven of the sites lie above water storage elevation but will be disturbed or destroyed by construction activities. The remaining seven identified sites, while in close propinquity to floodwater retarding structures, are not expected to be disturbed as a result of project actions.

General

The population of the watershed is rural. Watershed development with structures providing protection from flood hazards will promote community development. The structures will provide protection to flood plain lands for a more stable crop production. The relocation of any person or farm operation is not expected to result from the installation of project measures.

The increased production from flood plain lands, as a result of the project, will put new demands upon transportation, processing, and marketing industries. To meet these new demands, employment will be encouraged.

Farm operators, in order to make the most profitable use of the protected flood plain lands, will increase their purchase of fertilizer, seeds, and other supplies necessary for efficient production.

The project will reduce flash floods below structures that result in rapid inundation of roads and highways, endangering the lives of travelers. The reduction of these floods will also relieve landowners from much tension and worry. Such benefits as these are not monetarily evaluated but are real and are of importance to the community and nation.

PROJECT BENEFITS

The combined program of land treatment and structural measures will reduce annual flood damages within the watershed from an average of \$112,000 to \$22,650, a reduction of 80 percent. Approximately 95 percent of this reduction will result from structural measures.

The total damage reduction benefits by items are as follows (Table 5):

Floodwater	
Crop and Pasture	\$ 48,580
Other Agricultural	7,410
Nonagricultural	16,700
Sediment	
Overbank Deposition	4,730
Reservoir (Lake Eufaula)	330
Erosion	
Flood plain scour	1,080
Indirect	<u>10,520</u>
TOTAL	\$ 89,350 <u>1/</u>

1/ Of this amount, land treatment measures will provide flood reduction benefits amounting to \$5,350 annually.

The reduced flooding, as a result of the project, will encourage farm operators to restore flood plain lands to former productive levels. The benefits from this restoration of production are estimated to average \$31,560, annually, and are included in the reduction of crop and pasture damage. These benefits are principally a result of increased alfalfa and grain sorghum production.

The sponsors will cooperate with the State Health Department relative to standards for expected water uses.

Since recreation is not a project purpose, no recreation facilities are provided and no primary recreation benefits are claimed.

Project installation will provide opportunities for employment of local labor presently unemployed or underemployed. The average annual benefits from this source amounts to \$5,246 but have not been used for project justification since the watershed is not in a designated redevelopment area.

Secondary benefits, including increased business activity and improved economic conditions in the region and State will result from the installation of the completed project. These benefits are estimated to amount to \$16,450 annually. Secondary benefits from a national viewpoint were not considered pertinent to the economic evaluation of this project.

COMPARISON OF BENEFITS AND COSTS

The average annual cost of structural measures (amortized installation cost plus operations and maintenance) is \$67,993. The installation of the structural measures is expected to produce average annual primary benefits of \$84,010. The ratio of benefits to cost will be 1.2:1.0.

Total benefits, including secondary, from structural measures will amount to \$100,460, and will provide \$1.50 for each dollar of cost (Table 6).

PROJECT INSTALLATION

The Pott-Sem-Turkey Watershed Association was organized to bring the leadership of the watershed into one united group having a common goal. The group is composed of representatives from the sponsoring organizations and other groups interested in establishing, operating and maintaining watershed protection and flood prevention measures. The association will assist in establishing policies, initiating action, helping achieve understanding, and stimulating participation in the project.

The sponsoring organizations, with the assistance of the Extension Service, Vocational Agriculture, and other interested agencies, will carry out the educational phase of the program. This will be accomplished by conducting general information and local farm meetings, preparing radio and press releases, and using other methods of getting information to landowners and operators and other interested groups in the watershed. This will help achieve understanding and stimulate participation in the entire plan, including the land treatment practices and the structural measures for flood prevention.

Land Treatment Measures

Land treatment measures on privately owned land will be established by farmers over a 5-year period in cooperation with the Seminole County and Shawnee Conservation Districts. Land treatment measures on Indian land will be established by farm operators in cooperation with the Bureau of Indian Affairs work units. The Soil Conservation Service, Bureau of Indian Affairs, Oklahoma Forestry Division and the Oklahoma Department of Wildlife Conservation, through the districts, are giving assistance in planning and application of these measures under going programs.

Public Law 46 funds from the Soil Conservation Service have been made available for several years to get needed land treatment measures applied. This assistance will be continued to assure installation of the needed measures as rapidly as possible.

The governing body of the Conservation District will assume aggressive leadership in accelerating the planned land treatment measures. The landowners and operators within the watershed will be encouraged to apply and maintain soil and water conservation measures on their farms and ranches.

District-owned equipment will be made available to the landowners and operators in accordance with existing arrangements for equipment usage in the district. The Soil Conservation Service will provide additional technical assistance to the district to assist landowners and operators in accelerating the planning and application of soil, plant, and water conservation measures.

The soil and water conservation loan program of the Farmers Home Administration is available to all eligible farmers and ranchers in the area. Educational meetings will be held in cooperation with other agencies to

outline the services available and eligibility requirements. Present FHA clients will be encouraged to cooperate in the program.

The Oklahoma Department of Wildlife Conservation will assist the Service and the districts by providing technical assistance in planning and promoting the establishment of fish and wildlife habitat developments.

Structural Measures

The Soil Conservation Service has been formally requested by the sponsors to contract for the construction of the structural measures. The Seminole County Conservation District will be the sponsor designated to deal with the Service.

Land rights, road, utility, or other improvement modifications required by installation of the structural measures will be provided by the local sponsors at no cost to the Federal Government. The legal fees incurred in acquiring land rights for all structural measures will be furnished by local sponsors.

The local sponsors will secure easements from the landowners of the floodwater retarding structure sites to permit beneficial wildlife plantings within the fenced areas associated with four of the structures. The plantings and other mitigating measures listed in items 2 and 3 on page 22 will be included in the erosion control plan for the structures.

Federal funds may be provided for technical operations assistance for establishing land treatment measures and to provide land rights maps and other engineering information needed by sponsors to acquire easements and rights-of-way when project is approved and funds are made available for these purposes. Land rights maps are furnished to the sponsors when the Work Plan Agreement is signed.

Federal funds may be provided and construction of planned structural measures will be started when the conditions outlined below are met:

1. Land rights:
 - a. Either all necessary land rights or options for land rights have been obtained for all structural measures in the watershed.

- b. Sponsoring local organizations have adequate financial resources and legal authority to acquire land rights by eminent domain, and have satisfied the State Conservationist that they will use these powers and resources to secure all needed land rights.

2. Operation and Maintenance:

- a. A fund for maintenance is established to pay for uncontributed labor, equipment, and supplies.
 - b. The operation and maintenance agreement has been approved.
3. Goals are set to meet the following land treatment requirements for the construction of each structure in the plan:
- a. Farm and ranch conservation agreements to carry out recommended soil conservation practices on more than 50 percent of the farmlands in the drainage area above the floodwater retarding structures.
 - b. More than 75 percent of the effective land treatment measures above the floodwater retarding structures have been installed, or scheduled to be installed prior to completion of the floodwater retardation structures on those sediment source areas which, if uncontrolled, would require a material increase in the cost of construction and maintenance of the structure.

4. The project is approved and Public Law 566 funds are available.

Technical assistance will be provided by the Soil Conservation Service in planning, designing, preparation of specifications, supervision of construction, preparation of contract payment estimates, final inspections, executions of certificates of completion, and related tasks for the establishment of the planned structural measures for floodwater, sediment and erosion reduction. The various features of cooperation between the participating parties have been covered in appropriate memoranda of understanding and working agreements.

The Bureau of Indian Affairs has agreed through memorandum of understanding to assist on those structures which affect Indian land under their jurisdiction. They will give technical assistance to the local sponsors when Indian land is involved on easements and rights-of-way, review design and construction plans, and determine when proposed changes require additional rights-of-way.

A schedule to establish the structural measures within a 5-year period will be developed and adjusted from year to year on the basis of any significant changes in the plan to be mutually desired by the cooperating parties and in line with actual appropriations and accomplishments.

The potentials for improvement and preservation of wildlife habitat will be made known to landowners in the watershed. They will be provided with accurate technical information on the needs of wildlife and the methods and techniques compatible with their operation that would be used to provide these needs. Where there is a need and it is feasible and practical, local sponsors will encourage landowners to apply the following applicable practices for the express benefit of wildlife:

1. Strictly control or eliminate grazing on fenced dams and spillways.
2. Plant high-quality habitat plants on suitable locations within fenced areas.
3. Provide a water-level control structure in principal spillway drawdown tube.
4. Encourage and protect natural habitat along county roads, odd areas, fence lines, field borders, drainageways, etc.
5. Practice proper use on rangelands and tame pastures.
6. Make habitat plantings specifically for wildlife on selected sites, utilizing recommended and adaptable species of trees, shrubs, grasses and legumes.
7. Stock sediment pools with recommended species of fish only and encourage proper management.
8. Make provision for complete drainage of sediment pools for fish and waterfowl management purposes.
9. Prevent contamination of detention pools with undesirable fish by applying toxicants to all ponds on the watershed.
10. Make provision for access and utilization of fishery resource of stocked sediment pools.
11. Treat critical areas with plantings of high value to wildlife.
12. Install spawning devices for channel cat in sediment pools stocked with this species.

FINANCING PROJECT INSTALLATION

Federal assistance for carrying out the structural works of improvement, technical assistance for accelerated land treatment, and the Federal share of the relocation costs as described in this work plan will be provided under the authority of the Watershed Protection and Flood Prevention Act (Public Law 566, 83rd Congress, 68 Stat. 666) as amended.

Federal assistance is contingent upon local organizations meeting their necessary prior obligations and on the appropriation and allotments of Federal funds for these purposes.

The sponsoring organizations recognize their obligations and expected expense and are prepared to carry out their part of project installation.

Individual owners and operators will finance installation of land treatment measures on their land. The county ASC committees will cooperate with the governing bodies of the Conservation Districts by selecting and providing financial assistance for those practices which will accomplish the conservation objectives in the shortest possible time. The non-Federal cost of installing structural measures will be financed by the Seminole County, and Shawnee Conservation Districts and the Pott-Sem-Turkey Watershed Conservancy District.

The soil and water conservation loan program of Farmers Home Administration is available to all eligible individual farmers and ranchers in the area. The Farmers Home Administration will hold educational meetings in cooperation with other agencies to outline the services available and eligibility requirements. Present Farmers Home Administration clients will be encouraged to cooperate.

The local sponsoring organizations' financial responsibilities will be met principally by contribution of easements, services and monies, and through the use of State, County, and Watershed revolving funds. Landowners affected by structural measures were contacted by the local sponsors during the development of the work plan, and it was indicated that the major portion of the easements and rights-of-way would be donated.

The National Park Service has been designated as the responsible agency for the salvage or preservation of archeological materials by Public Law 86-523.

The Pott-Sem-Turkey Watershed Conservancy District has been organized in accordance with the laws of the State of Oklahoma and is a legal subdivision of the State. It has powers of eminent domain in watershed operations. The Conservancy District can accept contributions, assess benefited areas, issue warrants for preliminary work, hold elections for the issuance of bonds, and make annual levies to retire bonds. The Conservation Districts have authority to use State revolving funds as available after 90 percent of the needed easements are obtained. The sponsors will use donations, revolving funds, feasible private credit or other available means of meeting financial needs as they occur.

PROVISIONS FOR OPERATION AND MAINTENANCE

Land Treatment Measures

The land treatment measures on privately owned lands will be operated and maintained by the landowners or operators of the farms and ranches on which the measures are installed under agreements with the Seminole County, and Shawnee Conservation Districts and the Bureau of Indian Affairs. Representatives of the districts and the Bureau of Indian Affairs will make periodic inspections of the land treatment measures to determine maintenance needs and will encourage landowners and operators to perform needed maintenance. District-owned equipment will be made available for this purpose.

Structural Measures

The Seminole County Conservation District and the Pott-Sem-Turkey Watershed Conservancy District will operate and maintain the eleven floodwater retarding structures and the wildlife mitigating measures associated with Sites 1, 3, 4, and 8.

The estimated average annual value of operation and maintenance is \$3,300, based on current normalized prices and maintenance needs on similar watersheds. Necessary maintenance will be accomplished through the use of contributed labor and equipment, by contract, or by a combination of these methods.

Landowners will be encouraged and may agree to maintain the structures located on their lands. A maintenance fund will be established prior to awarding contracts for construction.

Prior to Federal funds being made available for construction through a project agreement, the local sponsoring organizations will prepare and execute an agreement satisfactory to the State Conservationist for operation and maintenance for structural measures to be installed. The maintenance agreement will declare the amount of funds on hand for maintenance purposes, also methods of replacing the funds as portions are used.

Provisions will be made for free access of District, State and Federal representatives to inspect all structural measures and their appurtenances at any time.

Operation and maintenance inspections for all floodwater retarding structures will be made on the following basis:

1. The Service employee responsible for operation and maintenance inspections and follow-up and the sponsors will make a joint inspection annually, after unusually severe floods, and after the occurrence of any other unusual conditions that might adversely affect the structural measures. These inspections will continue for three years following installation of each structure. Inspections after the third year will

be made annually by the sponsors. They will prepare a report and send a copy to the Service employee responsible for the operation and maintenance inspections and follow-up.

2. The Service employee responsible for operation and maintenance inspections and follow-up will thoroughly review the sponsors' reports of inspections and maintenance. Evidence that inspections or needed maintenance are not being performed properly and promptly will be reported immediately to the State Conservationist, who must then take appropriate action on the reported deficiencies.

An "establishment period" of three years after the acceptance of a structural work of improvement is hereby prescribed. During this period, the Service may bear such part of the cost of any needed repairs as is proportionate to the original cost borne by the Service in the construction of the works of improvement. Specifically excluded from this policy are:

1. Routine upkeep including replacement of minor or short-lived parts of structures, equipment, or facilities.
2. Repairs determined by the Service to have been caused by improper operation or routine upkeep or both.
3. Repairs for any purpose for which construction costs are not authorized to be paid for in whole or in part with funds appropriated to the Service.

With respect to any needed repairs during the "establishment period", no action should be taken by the Service or the local organization which would lessen or adversely affect any legal liability of the contractor or his surety for payment of the cost of repairs.

The sponsors understand and recognize their responsibilities in the operation and maintenance of the project measures.

They understand that the functions of operation and maintenance includes the items discussed in the following paragraphs and in addition any other unforeseen maintenance needs.

Operations -- Action taken by the sponsors to make the structure function as designed. Operation includes the operation of gates and other features to regulate the retention or release of water for flood control or other use in accordance with a predetermined plan. Operation must comply with state or local laws as they apply to the use and control of water.

Maintenance -- Work done by the sponsors to keep the structure in good operating condition during its useful life.

The maintenance of an adequate vegetative cover of desirable species requires the repairing and reseeding of eroded areas, cutting or spraying to remove or control undesirable vegetation, fertilization and proper grazing.

Earth dam maintenance should include replacement of soil removed by rodents, clean out or replacement of relief wells and drains, repair of damaged rip-rap, stabilization of slide areas, maintain dikes at proper elevation and replacement of eroded material, immediately revegetate any eroded areas that develop in the emergency spillway, and fence repairs.

The operation and maintenance agreement will include specific provisions for retention and disposal of property acquired or improved with PL-566 financial assistance.

TABLE 1 - ESTIMATED PROJECT INSTALLATION COSTS 1/
Pott-Sem-Turkey Watershed, Oklahoma

Installation Costs Items	Unit	Number to be Applied :	Estimated Costs (dollars) 1/						
			Technical Assistance By:			Other Funds			
			SCS	BIA	Total	SCS 2/	BIA 2/	FS 2/	Total : FS 2/ : BIA 2/ : NPS 3/ : Other 4/ : Total : Total
LAND TREATMENT									
Land Areas 5/									
Cropland	Acres	2,300	80	2,380					
Pasture	Acres	13,265	841	14,106					
Range	Acres	5,442	319	5,761					
Technical Assistance						17,000	850	17,850	500
TOTAL LAND TREATMENT						17,000	850	17,850	500
								14,149	181,334
									196,983
									214,833
STRUCTURAL MEASURES									
Construction	No.	11				635,645		635,645	
Floodwater Retarding Stru.						83,792		83,792	
Engineering Services									
Project Administration									
Construction Inspection						141,004		141,004	
Other 6/						18,033	2,800	20,833	
Project Adm. Subtotal						159,037	2,800	161,837	
Other Costs									
Archeological Salvage 3/									
Land Rights									
Other Costs Subtotal									
TOTAL STRUCTURAL MEASURES						878,474	2,800	881,274	
						895,474	3,650	899,124	500
								14,149	1,600
									395,843
									413,132
									1,312,256

1/ Price Base: 1974

2/ Federal agency responsible for assisting in installation of works of improvement.

3/ Archeological Salvage will be performed by the National Park Service with their funds.

4/ Includes reimbursement from ACP and other Federal funds under going programs.

5/ Includes only areas estimated to be adequately treated during the project installation period. Treatment will be accelerated throughout the watershed, and dollar amounts apply to total land areas, not just to adequately treated areas.

6/ Public Law 566 costs include Washington & State Offices. Other costs include local sponsor costs during construction.

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TABLE 1A - STATUS OF WATERSHED WORKS OF IMPROVEMENT

Pott-Sem-Turkey Watershed, Oklahoma

Measures	:	Unit	:	Number	:	Total
	:		:	Applied	:	Cost
	:		:	to Date	:	(Dollars)1/
<u>LAND TREATMENT</u>						
<u>Soil Conservation Service</u>						
Conservation Cropping System		Acre		3,900		51,285
Contour Farming		Acre		1,341		402
Crop Residue Use		Acre		4,240		2,756
Pasture and Hayland Management		Acre		6,735		3,368
Pastureland & Hayland Planting		Acre		8,049		108,662
Ponds		No.		301		150,500
Critical Area Planting		Acre		146		21,900
Cropland to Grassland		Acre		2,795		37,732
Deferred Grazing		Acre		1,800		3,600
Proper Grazing Use		Acre		4,050		608
Brush Control		Acre		737		11,276
Wildlife Habitat Development		Acre		18		1,800
SCS Sub-total						393,889
<u>Bureau of Indian Affairs</u>						
Cover Crops		Acre		80		1,200
Cropping System		Acre		947		947
Pasture Sodding		Acre		72		2,160
Residue Management		Acre		80		160
Ponds		No.		17		5,440
Wildlife Stocking		No.		17		510
Terraces		Mile		1.5		413
BIA Sub-Total						10,830
TOTAL LAND TREATMENT						404,719

1/ Price Base: 1972

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TABLE 2 - ESTIMATED STRUCTURAL COST DISTRIBUTION

Pott-Sem-Turkey Watershed, Oklahoma
(Dollars) 1/

Item	: Installation Costs - P.L. 566 :		Installation Costs		: Total
	:	:	:	:	
	:Construction:Engineering:P. L.566:Land Rights:Archeological: Total Other: Cost		Other Funds		
			4/	5/	
Floodwater Retarding Structures					
Site 1	63,638 2/	8,909	72,547	13,953	86,500
Site 2	44,061	6,169	50,230	20,495	70,725
Site 3	53,894 2/	7,545	61,439	29,770	91,209
Site 4	53,805 2/	7,533	61,338	16,238	78,776
Site 5	51,094	7,153	58,247	37,795	96,042
Site 6	78,736	9,448	88,184	18,740	106,924
Site 7	81,760	9,811	91,571	20,303	112,274
Site 8	42,874 2/	6,002	48,876	9,115	57,991
Site 9	29,882	4,183	34,065	12,860	46,925
Site 10	99,344	11,921	111,265	21,050	132,315
Site 11	36,557	5,118	41,675	10,430	52,105
Sub-Total	635,645	83,792	719,437	210,749	933,386
Project Administration			161,837 3/	3,800	165,637
TOTAL			881,274	216,149	1,097,423

1/ Price Base: 19742/ Includes Wildlife Mitigation Costs.3/ Includes \$2800 for BIA Project Administration Services.4/ Includes \$1800 for Road and Bridge Modifications

and \$10,400 for Utility Modifications.

5/ Archeological Salvage will be performed by the National Park Service with their funds.

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TABLE 3 - STRUCTURAL DATA

Pott-Sem-Turkey Watershed, Oklahoma

Item	Unit	Structure Number					
		1	2	3	4	5	6
Class of Structure		a	a	a	a	a	a
Drainage Area	Sq.Mi.	1.70	2.46	3.52	2.42	4.61	2.55
Curve No. (1 day)(AMC II)		75	75	75	75	75	75
Tc	Hrs.	1.14	1.71	2.07	.95	2.22	1.25
Elevation Top of Dam	Ft.	924.8	944.2	952.7	991.5	980.4	951.6
Elevation Crest Emergency Spillway	Ft.	922.8	942.2	950.7	989.2	978.4	949.4
Principal Spillway Crest Elev. (50-year)Ft.		912.6	932.4	940.8	976.9	968.5	939.4
Maximum Height of Dam	Ft.	23.8	23.2	24.7	22.5	25.5	22.6
Volume of Fill	Cu.Yds.	65,400	47,300	56,400	56,250	53,900	86,000
Total Capacity	Ac.Ft.	568	743	1,107	794	1,500	749
Sediment Submerged 1st 50-years	Ac.Ft.	73	90	122	115	194	82
Sediment Submerged 2nd 50-years	Ac.Ft.	68	84	114	107	182	74
Sediment Aerated	Ac.Ft.	20	25	34	31	52	22
Retarding	Ac.Ft.	407	544	837	541	1,072	571
Surface Area							
Sediment Pool (50-year)	Acres	22	34	40	25	54	26
Retarding Pool	Acres	79	109	180	96	224	114
Principal Spillway Design							
Rainfall Volume (Areal)(1 day)	In.	7.10	7.10	7.10	7.10	7.10	7.10
Rainfall Volume (Areal)(10 day)	In.	11.80	11.80	11.80	11.80	11.80	11.80
Runoff Volume (10 day)	In.	6.09	6.09	6.09	6.09	6.09	6.09
Capacity of Principal Spillway (Max.) cfs		28	50	56	31	69	51
Frequency Operation-Emer. Spwy.	%Chance	2.7	4.0	2.8	3.6	4.0	4.0
Dimension of Conduit	In.	18	24	24	18	24	24
Emergency Spillway Design							
Rainfall Volume (ESH)(Areal)	In.	6.50	6.50	6.50	6.50	6.50	6.50
Runoff Volume (ESH)	In.	3.71	3.71	3.71	3.71	3.71	3.71
Storm Duration	Hrs.	6	6	6	6	6	6
Type		Veg.	Veg.	Veg.	Veg.	Veg.	Veg.
Bottom Width		50	100	100	50	100	54
Velocity of Flow (Ve) 1/	Ft./Sec.	4.05	4.05	4.05	4.45	4.05	4.30
Slope of Exit Channel 1/	Ft/Ft.	.0310	.0310	.0310	.0290	.0310	.0300
Maximum Water Surface Elevation	Ft.	-	-	-	-	-	-
Freeboard Design							
Rainfall Volume (FH)(Areal)	In.	9.30	9.30	9.30	9.30	9.30	9.30
Runoff Volume (FH)	In.	6.22	6.22	6.22	6.22	6.22	6.22
Storm Duration	Hrs.	6	6	6	6	6	6
Maximum Water Surface Elevation	Ft.	924.8	943.9	952.4	991.5	980.2	951.6
Capacity Equivalents							
Sediment Volume	In.	1.77	1.52	1.44	1.96	1.74	1.31
Retarding Volume	In.	4.49	4.15	4.46	4.19	4.35	4.20

(See footnotes on last page of Table 3)

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TABLE 3 - STRUCTURAL DATA

Pott-Sem-Turkey Watershed, Oklahoma

Item	Unit	Structure Number					Total
		7	8	9	10	11	
Class of Structure							
Drainage Area	Sq.Mi.	3.32	1.31	1.50	1.70	1.22	26.31
Curve No. (1 day) (AMC II)		75	75	75	75	75	
Tc	Hrs.	1.98	.88	1.12	1.21	1.01	
Elevation Top of Dam	Ft.	941.0	968.0	916.7	951.7	949.8	
Elevation Crest Emergency Spillway	Ft.	938.5	966.0	914.7	946.7	947.8	
Principal Spillway Crest Elev. (50-Yr)	Ft.	926.0	955.9	906.2	933.2	939.1	
Maximum Height of Dam	Ft.	27.6	21.0	20.7	33.7	22.3	
Volume of Fill	Cu.Yds.	85,000	41,600	32,100	104,000	38,300	666,250
Total Capacity	Ac.Ft.	990	381	442	591	374	8,239
Sediment Submerged 1st 50-years	Ac.Ft.	103	38	52	59	45	973
Sediment Submerged 2nd 50-years	Ac.Ft.	95	36	49	55	42	906
Sediment Aerated	Ac.Ft.	29	10	14	16	12	265
Retarding	Ac.Ft.	763	297	327	461	275	6,095
Surface Area							
Sediment Pool (50-year)	Acres	30	13	20	16	17	297
Retarding Pool	Acres	123	54	75	66	60	1,180
Principal Spillway Design							
Rainfall Volume (Areal)(1 day)	In.	7.10	7.10	7.10	8.00	7.10	
Rainfall Volume (Areal)(10 day)	In.	11.80	11.80	11.80	13.25	11.80	
Runoff Volume (10 day)	In.	6.09	6.09	6.09	7.31	6.09	
Capacity of Principal Spwy. (Max.)	cfs	50	27	27	28	29	
Frequency Operation-Emergency Spwy.	%Chance	4.0	2.7	3.1	2.0	3.0	
Dimension of Conduit	In.	24	18	18	24	18	
Emergency Spillway Design							
Rainfall Volume (ESH)(Areal)	In.	6.50	6.50	6.50	9.30	6.50	
Runoff Volume (ESH)	In.	3.71	3.71	3.71	6.22	3.71	
Storm Duration	Hrs.	6	6	6	6	6	
Type		Veg.	Veg.	Veg.	Veg.	Veg.	
Bottom Width	Ft.	50	50	50	60	50	
Velocity of Flow (Ve) 1/	Ft./Sec.	4.68	4.05	4.05	3.39	4.05	
Slope of Exit Channel 1/	Ft./Ft.	.0280	.0310	.0310	.0340	.0310	
Maximum Water Surface Elevation	Ft.	-	-	-	948.3	-	
Freeboard Design							
Rainfall Volume (FH)(Areal)	In.	9.30	9.30	9.30	15.70	9.30	
Runoff Volume (FH)	In.	6.22	6.22	6.22	12.31	6.22	
Storm Duration	Hrs.	6	6	6	6	6	
Maximum Water Surface Elevation	Ft.	941.0	968.9	916.5	951.7	949.4	
Capacity Equivalents							
Sediment	In.	1.28	1.20	1.44	1.43	1.53	
Retarding Volume	In.	4.31	4.26	4.09	5.09	4.22	

1/ Based on 25 percent of the maximum discharge during passage of the freeboard hydrograph except structure number 10.

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TABLE 4 - ANNUAL COST

Pott-Sem-Turkey Watershed, Oklahoma
(Dollars)

Evaluation Unit	: Amortization of : Installation : Cost <u>1/</u>	: Operation and : Maintenance : Cost <u>2/</u>	: Total
Floodwater Retarding Structures Nos. 1 through 11	54,929	3,300	58,229
Project Administration	9,764	xxx	9,764
TOTAL	64,693	3,300	67,993

1/ Price Base: Based on 1974 prices, amortized in 100 years
at 5.875 percent.

2/ Current prices.

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TABLE 5 - ESTIMATED AVERAGE ANNUAL
FLOOD DAMAGE REDUCTION BENEFITS

Pott-Sem-Turkey Watershed, Oklahoma
(Dollars) 1/

Item	: Estimated Average Annual Damage		Damage Reduction Benefit
	:	:	
	: Without Project	: With Project	
Floodwater			
Crop and Pasture	57,760	9,180	48,580
Other Agricultural	10,240	2,830	7,410
Non-Agricultural			
Roads and Bridges	22,440	5,740	16,700
Subtotal	90,440	17,750	72,690
Sediment			
Overbank Deposition	6,730	2,000	4,730
Reservoir (Eufaula)	570	240	330
Subtotal	7,300	2,240	5,060
Erosion			
Floodplain Scour	1,180	100	1,080
Indirect	13,080	2,560	10,520
TOTAL	112,000	22,650	89,350

1/ Price Base: Current normalized, dated 10/15/73.

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TABLE 6 - COMPARISON OF BENEFITS AND COSTS FOR STRUCTURAL MEASURES

Pott-Sem-Turkey Watershed, Oklahoma
(Dollars)

Evaluation Unit	: AVERAGE ANNUAL BENEFITS 1/				: Average		: Benefit	
	: Damage		: :		: Annual		: Cost	
	: Reduction		: Secondary		: Total		: Cost 3/	
Floodwater Retarding Structures 1 thru 11	84,010		16,450		100,460		58,229	1.7:1
Project Administration	xxxxxx		xxxxxx		xxxxxxxx		9,764	xxxxx
GRAND TOTAL	84,010 2/		16,450		100,460		67,993	1.5:1

1/ Price Base: Current normalized (dated 10/15/73).

2/ In addition, it is estimated that land treatment measures will provide flood damage reduction benefits of \$5,340 annually.

3/ From Table 4.

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INVESTIGATIONS AND ANALYSIS

Land Use and Treatment

Land Treatment Measures

Current conservation needs and amounts of conservation practices applied to date were based on estimates by Soil Conservation Service personnel from records of basic conservation plans on 50 percent of the watershed. Based on the needs and local experience, an estimate was made of the measures that could be applied in the 5-year installation period. The acres to be treated and cost of treatment measures are shown in Table 1. Although needed land treatment measures would have an effect in flood damage reduction, it was apparent that structural measures would be required to attain the degree of flood protection desired.

Soil Cover Conditions

Estimates of the soil cover conditions on the upland area were made from existing work unit records, soil surveys, and studies of geological formations. Data covering land use of the floodplain were developed during economic investigations.

WILDLIFE INVESTIGATIONS

Personnel from the following agencies participated in the biological reconnaissance trip within the watershed: Oklahoma Department of Wildlife Conservation, United States Fish and Wildlife Service, and the Soil Conservation Service.

A biological reconnaissance report was written for the watershed discussing the general nature and importance of the wildlife resources, effects of project measures on wildlife resources, and the possibilities of lessening damages and enhancing wildlife habitat.

FIELD SURVEYS

The Oklahoma State Conservation Commission furnished a field survey party staffed by State employees to provide the data listed below as the State of Oklahoma's contribution to the development of this watershed work plan.

- | | |
|---------------------------------|----------------------------|
| 1. Field surveys. | 2. Engineering data. |
| a. Horizontal control. | a. Plotted cross-sections. |
| b. Valley cross-sections. | b. Site topography maps. |
| c. Site topographic mapping. | c. Storage curves. |
| d. Channel improvement surveys. | d. Land rights maps. |

ENGINEERING INVESTIGATIONS

After considering the effect of land treatment measures, determination of the needed structural measures was made using the following procedures:

1. A base map of the watershed was prepared showing the watershed boundary, drainage pattern, system of roads and other pertinent information. Stereoscopic study of consecutive 4.00 inch aerial photographs was used to locate possible floodwater retarding structure sites and valley cross sections, to delineate the floodplain and determine the drainage area of possible sites.
2. A field examination was made of floodwater retarding structure sites previously located stereoscopically. Sites for which it was apparent that sufficient storage capacity could not be developed were relocated or dropped from further consideration. From the remaining sites, a system of structure sites was selected for further study and detailed survey. Plan of a typical floodwater retarding structure planned for this watershed is illustrated by Plate 1.
3. Topographic maps with 4-foot contour intervals and a scale of 1 inch = 200 feet were developed from engineering surveys of the pool area of most of the sites. USGS quadrangle sheets, 7.5 minute series, and aerial photographs were used to develop structural data for Site 4.

The height of the dams and the size of the pools were determined by the storage volume needed to detain the runoff from the design storm and to provide the additional storage needed for 100-year sediment yield. Top of principal spillway riser to be placed at 50-year sediment volume.

Structure data tables were developed to show the drainage area, storage capacity planned for floodwater detention and sediment, release rate of the principal spillway, emergency spillway capacity, area inundated by the pools and other pertinent data for each structure (Table 3).

Floodwater detention capacity was planned in the structures to temporarily detain the expected runoff from 25-year and 50-year frequency, 10-day duration periods. Class a structures will contain the 25-year and class b, the 50-year. The criteria for obtaining the minimum storage was based on the National Engineering Handbook, Section 4. All detention volumes equal or exceed the minimum. Embankment volumes were computed in accordance with instructions contained in Oklahoma Supplement 11 to the National Watershed Protection Handbook, Part 3, Chapter 1, Page 3100.

Contract cost estimates were based on:

- a. Computed embankment yardage.
- b. Estimated rock excavation.
- c. Estimated acres of timber clearing.
- d. Principal spillway type, height, length and capacity.
- e. Estimated foundation drainage.
- f. Other - including fencing, vegetation, slope protection, etc., using current contract costs plus contingencies.

The emergency spillway hydrographs were developed from the procedure outlined in the Soil Conservation Service National Engineering Handbook, Section 4, Hydrology, Part I, Chapter 21. The most economical structure was determined by computer routings and the spillways were proportioned accordingly.

4. The principal spillway release rates were determined in accordance with Engineering Memorandum SCS-27, (Rev.), Supplement 5, Section E. In keeping with guidelines for principal spillway selection and structure analysis in Supplement OK-4, Engr. Memo. 27 (Rev.), all structures except site number 10 are planned for full pipe flow, with 18" I.D. and 24" I.D. pipes. Structure number 10, the only class b structure, has 24" I.D. pipe and a restricted flow riser. Class a structure release rates varied from 13 to 24 CSM. Site number 10, the class b structure, has a release rate of 17 CSM. Planned release rates will empty the retarding pools in ten days or less.
5. Costs of structural measures and of land rights, modification of roads, bridges, pipelines and power lines were considered in arriving at the least costly system of measures to accomplish the project objectives. The cost of the structural measures is shown in Table 2.

Operation and maintenance costs for structural measures were based on the cost for similar structures installed on other watersheds. These costs were based on current normalized prices as transmitted in the "Interim Price Standards for Planning and Evaluating Water and Land Resources" April 1966.

The combined project for flood prevention was evaluated. Studies were made and data developed to show the total cost of each type of measure and the portion of the cost to be borne by the participants. A summation of the total costs for all planned measures is shown in Table 1. A second cost table was developed to show the annual installation costs, annual maintenance cost and total annual cost of the structural measures (Table 4). The total annual costs were compared with total annual benefits in Table 6.

HYDRAULIC AND HYDROLOGIC INVESTIGATIONS

The following steps were taken as a part of the hydraulic and hydrologic investigation and determination:

1. Engineering surveys were made of channel and valley cross sections selected to represent the average stream hydraulics and the floodplain area. Preliminary locations for channel and valley cross-sections were made by examination of detailed soils photographs. Final locations were selected after reconnaissance of the watershed.
2. Hydrologic conditions of the watershed were determined by considering such factors as climate, geology, topography, soils, land use, and vegetative cover. From this, soil cover complex data were assembled for present and future conditions. Future hydrologic cover conditions were determined from expected change in land use with an accelerated land treatment program during installation period.
3. Rating curves (stage vs discharge) were developed for cross-sections from field survey data collected as described in item 1 above, by computing water surface profiles for various discharges. The profiles were run by machine using the water surface profile program.
4. Hydrographs for hydrologic unit source areas were developed and routed for a range of frequency events using the computer program for project formulation (SCS Technical Release #20) to determine the volume-peak discharge relationship at selected valley cross-section locations. Routings were made with two different combinations of structures. From the results, the most suitable combination was selected for the final system of structural measures.
5. The frequency method of analysis was used to evaluate the project. Rainfall information for the selected frequency storms was obtained from the U. S. Weather Bureau Technical Paper No. 40. The runoff from the 100-year frequency storm was flood routed to determine the floodplain area to be used in computation of damages and benefits. The seasonal flood distribution was determined from an analysis of runoff producing rains of three gages in the area for a period of 29 years.
6. Inundation of the floodplain area by depth increments by each storm in the evaluation series was determined under conditions that would exist due to:

- a. The present conditions of the watershed.

- b. The installation of floodwater retarding structures.
(Further reduction of flooding from the installation of land treatment measures was estimated.)

- 7. The appropriate spillway design storms were selected from criteria contained in the National Engineering Handbook, Section 4, Hydrology, and Engineering Memorandum SCS-27.

Spillway design and freeboard hydrographs were developed for each of the floodwater retarding structures and routed by computer with three different spillway bottom widths. From the results, the most desirable combination of emergency spillway width, depth and elevation was selected based on economy and safe design.

- 8. The principal spillway release rates were varied from 12 to 20 CSM. Factors influencing rates were: channel capacities below structures, effect on downstream peak discharges, emptying time of retarding pools and total structure cost.

SEDIMENTATION INVESTIGATIONS

Field investigations of sedimentation problems were made in accordance with the South Regional Technical Service Area Guide to Sedimentation Investigations (March 1965), and Technical Release No. 12, "Procedure for Computing Sediment Requirements for Retarding Reservoirs" (September 1959).

Sediment Source Studies

In accordance with the above mentioned references, sediment source studies were made by detailed and semi-detailed surveys on drainage areas above proposed floodwater retarding structures to determine annual gross erosion from all sources. Erosion rates were calculated for separate land areas based on land use, soil unit, slope and cover conditions. The Musgrave soil loss equation was used.

Detailed sediment investigations were made of the drainage area above five floodwater retarding structures, or approximately 45 percent of the total drainage area above sites. From these studies the sediment yield to each structure for the 100-year design storage period was calculated. The sediment yield for the remaining seven sites were expanded from the detailed sites. Allocation of sediment storage capacity for sites is approximately 43 percent to the first 50-year sediment pool, 40 percent to the second 50-year sediment pool, and 17 percent to the detention pool. The densities of soil in place, submerged sediment and aerated sediment were estimated to average 95, 60, and 91 pounds per cubic foot, respectively. The total annual amount of sediment deposited in all sites is estimated to be 21.4 acre-feet. The average annual rate of sediment deposited in the structures is estimated to be 0.81 acre-feet per square mile. Of the sediment delivered to structures, approximately 91 percent is from sheet erosion, 7 percent from gully, and 2 percent from roads and floodplain scour above sites. The delivery ratios per square mile for downstream deposition are as follows: sheet erosion, 52 percent; and roads and gullies, 80 percent. The delivery ratio for sediment to Eufaula Reservoir is 40 percent of the sediment delivered to the mouth of the watershed.

Floodplain Sedimentation and Scour Damage

The cross-section method was used in determining floodplain damages. Borings were made along most of the hydrologic cross-sections. Conditions of the streambed and banks also were noted. Findings were prepared in tabular summary for the economist to calculate monetary damages and benefits.

GEOLOGICAL INVESTIGATION

Preliminary geological investigations were made on all proposed sites. The investigations included surface and sub-surface studies of the geological formations, topography, valley alluvium, and stream channels. The Bull Soil Sampler and hand auger were used in making these investigations. Form SCS-375 was completed for each site giving estimates of the amount of rock excavation, availability of borrow material, location of emergency spillway and other factors that affect the cost of the floodwater retarding structures. Sites located in the Konawa Formation are not expected to have rock in the emergency spillway. Sites 8, 9, and 10, located in the Vanoss and Ada formations, are expected to have from 30 to 60 percent rock excavation in the emergency spillway. All sites appear to have sufficient borrow material in the sediment pool area. If construction is during a wet season, fill material for a few sites will have to come from the floodpool area. Fill material will consist of CL, ML, and SM materials. Shale may be used in some structures. These shales are weathered and of a soft variety which should break down for good consolidation. Shallow cut-off trenches should be satisfactory on most structures. Very few, if any, structures should require drains. Further detailed studies of these problems will be made prior to final design and construction of the structural measures.

Geological Formation

Site Number

Konawa
Vanoss
Ada

2, 3, 4, 5, 6
1, 7 & 8
9, 10, 11

ECONOMIC INVESTIGATION

Land Treatment

Land treatment benefits were estimated to be five percent of the damage reduction benefits. This estimate was based on a comparison of the watershed with similar watershed of like cover conditions and Land Resource Area.

Direct and Indirect Floodwater Damage Reduction Benefits

Damage schedules representing about 40 percent of the watershed floodplain were obtained from landowners and operators of the area. The schedule information covered land use and crop distribution, yields, land values, flooding events, and flood damages. Analysis of the schedule information and supplemental data from similar watersheds formed the basis for estimating flood damage rates.

The evaluation was made by the frequency method of analysis. Economic and hydrologic input data sheets were prepared and submitted for computation by computer. The output data furnished crop and pasture, other agricultural, and nonagricultural damages and benefits for the watershed. Computer computations were made of three alternates. Alternate No. 1 was of flood damage with land treatment. The remaining alternates gave the damages and benefits as a result of two different systems of floodwater retarding structures. One system included eleven (11) structures and the other, twelve (12) structures. The alternate including eleven (11) structures was used for work plan development. This system was considered to be the more effective system in relation to cost.

Crop and pasture yields were projected in the data submitted for computer analysis. Projections were based on data from Oklahoma State University and other available sources.

Adjustments were made in crop and pasture damage for flood recurrence.

Non-agriculture and other agricultural damages were projected, on the basis of per capita income as shown in the OBE, 1968, report to the Water Resources Council. Projections were to the year of 2000. The income for this year being considered as an average for the 100-year evaluation period.

The monetary value of physical damage to the floodplain from sediment deposition and floodplain scour was based on the net value of production lost, taking into account the time lag for recovery. Sediment reduction benefits to Lake Eufaula were made on the basis of loss of storage capacity.

Indirect damages consist primarily of the extra travel time to market, interrupted travel, late deliveries, loss of business and loss of employment. These damages were estimated to be 10 percent of crop and

pasture, other agricultural, overbank sediment deposition, and erosion damages plus 20 percent of non-agricultural damages.

Enhancement Type Benefits

Operators of flood plain lands, when interviewed for flood damage information, were asked what land use changes they had made as a result of past flooding and the changes they would make if floodings were reduced significantly. An analysis of this information provided the basis for estimating land use changes and benefits that would accrue from the restoration of the flood plain to a level of its former productive value.

Secondary Benefits

Secondary benefits were evaluated principally on the basis of economic impact studies made by economists and marketing specialist associated with Oklahoma State University. The multiplier effects on the economy, as a result of added benefit returns, was taken from a summary report in an OSU publication identified as Science Serving Agriculture No. 808.

Secondary benefits were estimated to equal: 46 percent of direct crop production benefits; 43 percent of non-agricultural benefits; and 63 percent of incidental recreation benefits. The benefits from these sources were reduced 88 percent to compensate for leakage.

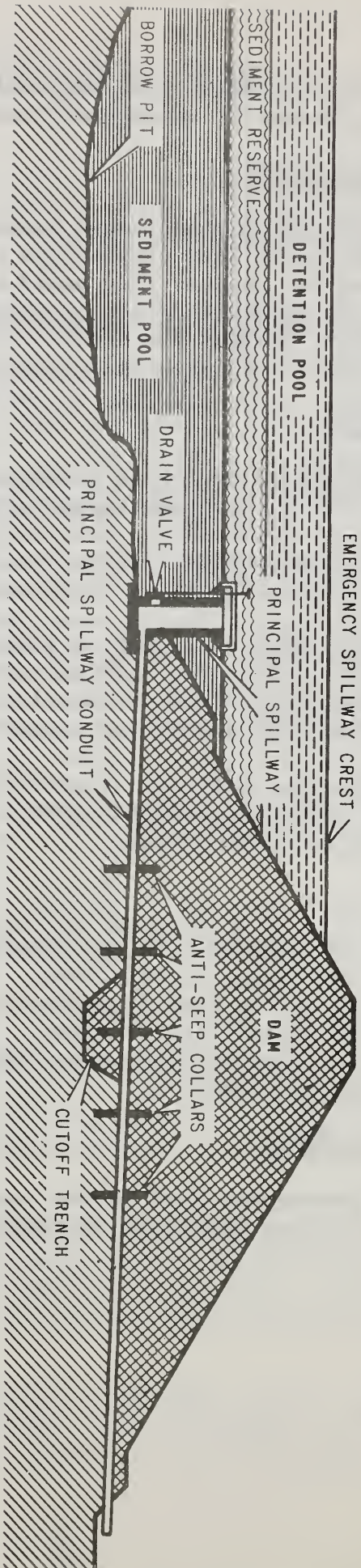
Secondary benefits, as a result of cost increases associated with enhancement and operation and maintenance costs were estimated to equal 10 percent of these costs.

Induced Costs

Areas that will be inundated in the floodwater retarding structures were excluded from damage calculations. However, an estimate was made of the value of the loss of production and secondary costs in these areas after project installation. This loss was less than the amortized value of land in pool areas; therefore, the amortized value was used as a project cost.

METHODS AND PROCEDURES

Details of the procedures used in the investigation are described in the Economic Guide for Watershed Protection and Flood Prevention.



SECTION OF A TYPICAL FLOODWATER RETARDING STRUCTURE

PLATE 1

Site No	Acres
1	1,088
2	1,574
3	2,253
4	1,549
5	2,950
6	1,632
7	2,125
8	838
9	960
10	1,088
11	781

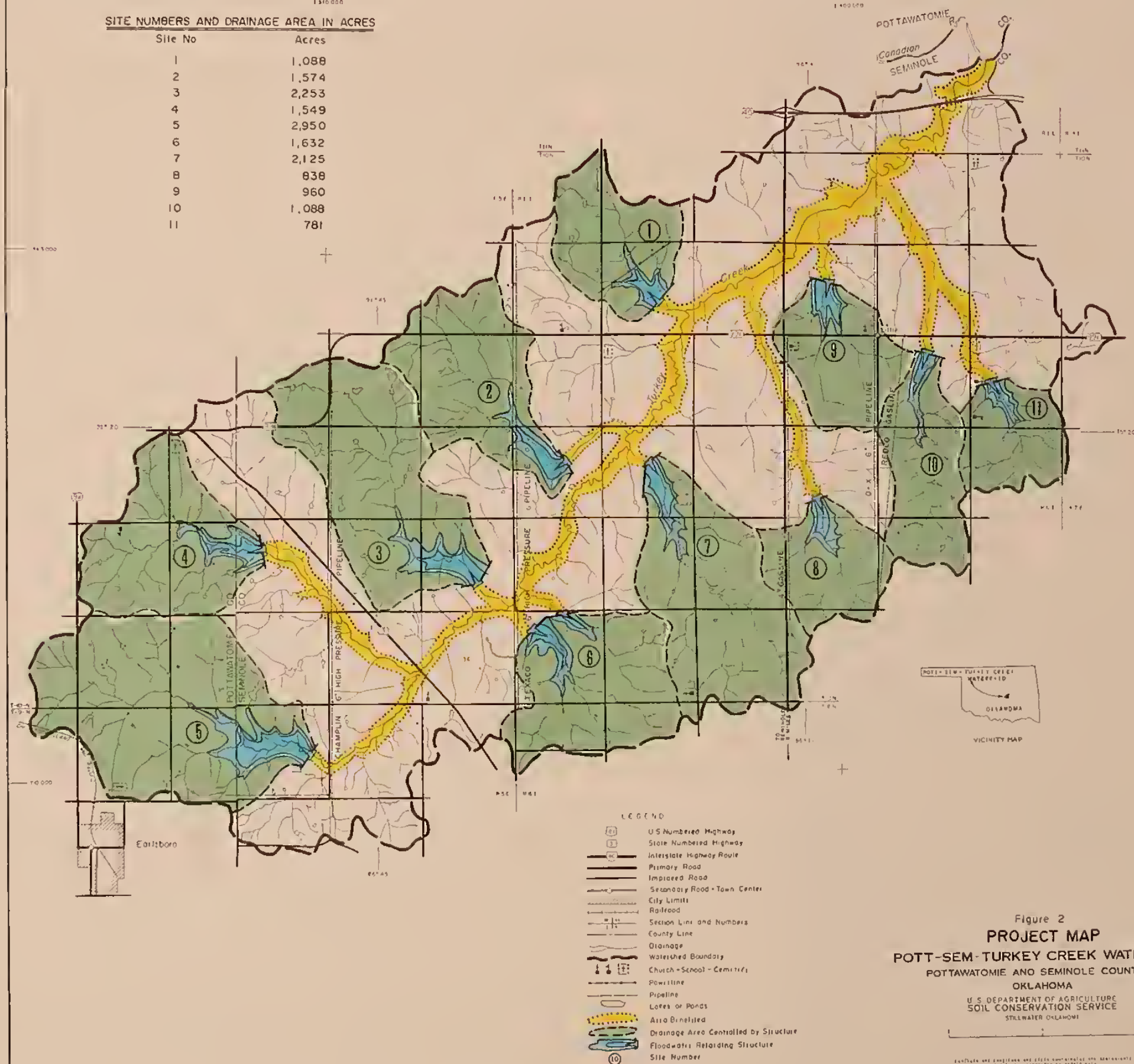


Figure 2
PROJECT MAP
POTT-SEM-TURKEY CREEK WATERSHED
POTTAWATOMIE AND SEMINOLE COUNTIES.
OKLAHOMA
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
STILLWATER, OKLAHOMA

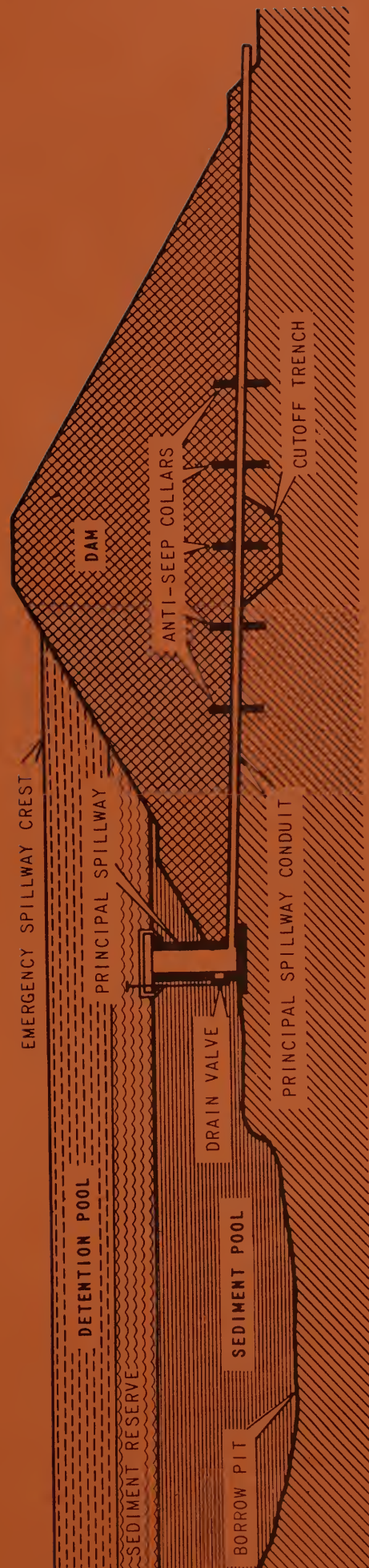
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1st Central Division Map

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SECTION OF A TYPICAL FLOODWATER RETARDING STRUCTURE

